GEOGRAPHY OF ODISHA

G.C.Ray

NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
CHINA
THE WORLD

KITAB MAHAL

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Location :

Odisha extends from 17°49' N to 22°34' N latitude and from 81°29' E to 87°29' E longitude on the eastern coast of India. It has an area of about 155,707 sq. km. according to the Census of India, 2001. It is bounded by the Bay of Bengal on the East, West Bengal on the North-East Jharkhand on the North, Chhattisgarh on the West and Andhra Pradesh on the South.

HISTORICAL EVOLUTION

The history of Odisha dates back to antiquity, its most famous old names being Kalinga, Utkal and Odra, when its boundary extended far beyond the present one. By the time of the Mahabharata Kalinga, Utkal and Odra had entered into Aryan polity as powerful kingdoms. Frequent reference is made to Kalinga in the Mahabharata and infrequent references to Odra and Utkal. By the time of Mahavir and Buddha, the Kalinga-Utkal region on the entire east coast of India acquired recognition and fame.

The political history of Odisha opens with the rule of Nanda, Emperor of Magadha. The Hatigumpha inscription of Emperor Kharavela at Udaygiri refers to a Nanda King twice. When Chandragupta Maurya succeeded to the throne of Nanda, Kalinga did not form part of his empire. Ashoka's invasion of Kalinga was an epoch-making event of ancient times of far-reaching consequences. The battle was described by Asoka himself in his thirteenth Rock Edict which records : "One hundred and fifty thousand men were carried away captive from that country, as many as one hundred thousand were killed there in action and many times that number perished." Kalinga was conquered but the conquest changed the heart of the conqueror. This change in Asoka changed the course of religion and cultural history not only of India but also of the whole of Asia.

The next great epoch of Odishan history was the time of Kharavela who ruled in the first half of the second century B.C. He defeated the Satakarni in the west, the Musikas on the bank of the Krishna as also the Rashtrikas and the Bhojakas, the rulers of Rajagriha and king Brihaspati Mitra of Magadha. In the thirteenth year of his rule, he retired to Khandagiri near Bhubaneswar. He was a Jain.

The history of Odisha for several centuries after Kharavela is dark. From Hiuen Tsang's account it is evident that Harsha Siladitya's political way extended to Odisha. Ptolemy, the famous Greek Geographer of the 2nd century AD, testified to the existence of flourishing trade marts on the Odisha coast. In the 8th century AD Odisha's overseas activities were at their peak when the Sailendra Empire in present day Malayasia was established. According to Arab sources, the empire extended its power even into Cambodia and Assam. The prosperity of the Sailendra Empire continued through the 10th century AD.

From the 8th to the 10th centuries AD the Bhauma Kara dynasty ruled over Utkal. Odiya language was just beginning to take shape during this age. This Bhauma Kara were followed by the Somas and the Kesharis. The famous Lingaraj Temple at Bhubaneswar was built by Yajati Keshari and completed by his successors.

By the end of the 12th century AD Anantavarman Chodagangadeva (1078-1191) of the Ganga dynasty is credited with having ruled over the region extending from the Ganga to the Godavari. He shifted his capital from Kalinganagar in Parlakhemundi to Cuttack. Vaishnavism received royal patronage and Vaishnavite temples were built at Mukhalingam, Shrikurmam, Simachalam and Puri. The temple at Puri was completed by Anangabhimadeva. In the 13th century the Ganga empire had the power to thwart a Muslim invasion.

In the 13th century when Hindu architecture in the north faced its worst days of ravage and destruction, Odiyan architecture reached its zenith with the construction of the famous Sun Temple of Konark by Narasimhadeva I (AD 1238-1264). It is recognised as the crowning glory of Hindu architecture.Then came the Surya dynasty. The first Surya King, Gajapati Kapilendradeva (1435-1466), defeated the Muslim ruler of Bengal, the Hindu ruler of Vijayanagar and Kanchi and the Bahamani Sultan. Kapilendra in fact himself advanced to Bidar, the capital of the Bahamani Empire. His empire extended from the Ganga in the north to the Kaveri in the South. His grandson, Prataparudradeva, became a devout disciple and with his death Surya rule declined. Mukundadeva the last independent king of Odisha, was killed in 1568 while fighting Afghans of Bengal. With his death Odisha lost its independence and thus became almost the last Hindu kingdom of India to fall to the Muslims.

The Moghuls ruled Odisha for a little over a century. During Aurangzeb's rule, however, a revolt was started under the leadership of Raja Krishna Chandra Bhanj of Mayurbhanj, but it was suppressed, though with great difficulty. After Aurangzeb's death, when the Moghul empire declined, Odisha passed under the rule of the independent Nawabs of Bengal.

In 1741, the Bhonsala Raja of Nagpur invaded Odisha under the leadership of Bhaskar Ram (Bhaskar Pandit). Alivardi Khan, the Nawab of Bengal, was compelled to cede Odisha to the Marathas whole rule lasted until the British conquered it in 1803.

Within two decades of Vasco-da-Gama's discovery of the sea-route to India, the Portuguese had established a flourishing trade mart at Pipli, at the mouth of the Subarnarekha. The English had established trade settlemetts at Hariharpur and Balasore by 1633. In subsequent years, the Dutch, the Danes and the French appeared at Balasore and established their respective footholds. In 1757, when the Battle of Plassey was fought and won, the legal title of Nawab of Bengal, Bihar and Odisha passed on to the English. In 1765, Shah Alam granted the East India Company the Dewani of Bengal, Bihar and Odisha. But this Odisha was only a small territory to the north of the Subarnarekha. Lord Wellesley (1798-1805) asked the Bhonsala Raja of Nagpur to enter into a "Subsidiary Alliance", but the Raja refused. The Anglo-Maratha war resulted in the British conquest of Odisha in 1803. Owing to misrule of the British, the Paika Rebellion was started under the leadership of Bakshi Jagabandhu Bidyadhar, the military chief of the Raja of Khurda. In April 1817, Puri fell to him and the British retreated to Cuttack. In the end, however, the rebellion was crushed. In 1857, Sambalpur played a leading role in the great Indian revolt. The worst evil of the British administration was witnessed in 1865-66 during the Na Anka famine in which more than ten lakhs of people, comprising about a quarter of Odisha's population, died of starvation.

The detailed report was published by Karmaveer Gouri Shankar Ray in Utkal Deepika. Although he was a Government servant, he bravely followed the ethic of journalism at the risk of his service.

The social reformers of Odisha like Fakir Mohan Senapati, Bhagban Chandra Das, Radhanath Ray, Madhusudan Rao and Madhusudan Das, shaped the destiny of Odisha in various significant ways. During the First World War a forceful movement was organised and led by Pandit Gopabandhu Das. As a result, Odisha was separated from Bihar and came into existence on 1st April, 1936. Soon after this, the Gadajat Revolt of the princes of the States was suppressed in 1938. Odisha took full part in the 1942 movement when more than 3,000 persons were thrown behind the bars and about 100 persons were killed as a result of machine-gun firing. After the attainment of Independence, the princely States merged with the major unit in 1948 and the new State of Odisha was formed.

An administrative reorganisation of the State was taken in hand and thirteen districts were formed. Out of the former princely Sates the district of Mayurbhanj, Sundargarh, Keonjhar, Dhenkanal, Phulbani, Bolangir and Kalahandi were carved out.

As a result of the work of the States Reorganisation Commission, the princely States of Sareikala and Kharasuan were merged with Bihar. Earlier, they were parts of the Mayurbhanj district.

In 1948, the capital of Odisha was moved from Cuttack to Bhubaneswar to the 32 km south and 45 m above mean sea level.

Iron & steel plant and fertilizer plant at Rourkela, Mig Factory at Sunabeda, Paper Mill at Brajarajnagar, Cement Factory at Rajgangpur, Ferrochrome factory at Jajpur Road, Aluminium Complex at Koraput, Aluminium factory at Hirakud, Multipurpose Dam project of

Hirakud and Busy port Paradeep are the tacit examples of progressive economy of Odisha since 15th August, 1947. But the percentage of population below poverty line (as per Bureau of Statistics, Government of Odisha) in rural areas was 25·11% and in urban areas 20·31% in 2011-12, which poses a challenge for the administrators to solve the problem. It is now the time to build future glorious history of Odisha through adequate infra-structure and integrated development in a synthetic way so that nobody should remain below poverty line. The past glorious history of Kalinga can be retained for future.

ARCHAEOLOGICAL TREASURES

The antiquities of Odisha go back to prehistoric period when Early Man know only the use of stone tools. Though no fossilized human remains have as yet been discovered, the vestiges of Lower Palaeolithic Culture in the form of crude stone artifacts used by man were recovered from the districts of Sambalpur, Dhenkanal, Keonjhar, Sundargarh and Mayurbhanj. No systematic and intensive exploration has been undertaken in any of these districts except in some parts of Mayurbhanj. The latter, particularly the valley of Burhabalang river and its tributaries from Baripada to Bangriposi (a distance of about 34 km) yielded a rich crop of palaeoliths—predominantly hand axes, cleavers, ovates and scrapers. Broadly analogous in form and technique to the abbevillian-Acheulian tools of Europe and Africa, these artifacts were essentially a core-industry, though with an admixture of pebble-tools. Among the sites of Mayurbhanj, Kuliana, the only site till now excavated, alone produced several hundred tools.

At the dawn of Odiyan history stands the figure of Asoka, the Mauryan Emperor, who has left two sets of his Major Rock-Edicts at Dhauli (District Puri) and Jaugada (District Ganjam). Significantly enough, the fact of his conquest of Kalinga, which involved great carnage, is omitted in these two versions of his Edicts, though it finds mention in his Major Edicts at other places. In the Odiyan version, the corresponding edicts are conciliatory in tone towards the newly conquered people of Kalinga.

On the top of his edicts at Dhauli is the rock-cut fore-part of an elephant, which represents the earliest sculpture of Odisha.

Also significant is the fact that the two sets of edicts are associated with two forts, the Dhauli one with Sisupalgarh, barely 5 km away (there being no other rock nearer Sisupalgarh for inscribing the edicts) and the Jaugada one with a fort, inside which the edict-bearing hillock being situated. The conclusion is inevitable that the two forts, respectively represent Tosali and Samapa, to the officers of which the edicts are addressed. The forts, which thus must have originated in the pre-Ashokan days, have an identical lay-out of their fortification, there being two gates with projecting arms on each of the four rampants of the fortification, roughly square on plan in both the cases. These two forts, on excavation, have furnished a very good idea about the military architecture of the country in those days.

Of these two cities, Sisupalgarh presents a more impressive view. Excavation here revealed the remains of an elaborate gateway-complex and part of a well-planned city with houses and cross-streets. The excavated Western gateway and the connected fortification showed an extensive renovation after their initial construction and it is very likely that the renovation was due to the Mahameghavahana King Kharavela (first century B.C.) of the Cheti dynasty of Kalinga, under whom Tosali under the changed name of Kalinganagara might have continued to be the capital.

Kharavela and the members of his family are immortalized by their excavation of a number of caves in the hills of Udayagiri and Khandagiri near Bhubaneswar, for the residence of Jaina ascetics. The sculptured friezes on some of these caves and also on others of unknown authorship are unique documents of the artistic outburst of the eastern Indian sculptors. Further the structural temple unearthed on the crest of Udayagiri is one of the earliest specimens of unify structures in eastern India.

Occupation continued at Sisupalgarh and Jaugada till post-Kushan days. Otherwise the archaeological history of Odisha is still now almost a blank in the first few centuries of the Christian era, except the sporadic finds of Kushan, Puri-Kushan and Gupta coins and a few sculptures. In about the seventh century, however, sprang forth an architectural outburst which went on gaining momentum under the successive dynasties of Sailodbhavas, Bhaumakaras, Somavamsis and the Gangas. The activity continued unabated under the Gajapatis and their successors, in a degenerate form, till it reached its end with the end of the Hindu rule in Odisha.

Essentially the temple-architecture of Odisha forms part of the north Indian architecture as a whole, but so distinctive is its individualistic development that it won for it a separate recognition under the name of Kalinga order, a rare honour enjoyed by very few States of India. This order transcends the limits of the present-day Odisha and its products are found as far South-West as Andhra Pradesh, a leading centre being Mukhalingam, which formed part of ancient Kalinga.

As in other parts of India, art here is intimately associated with architecture. Thus the exterior faces of the walls are embellished with an abundance of reliefs and sculptures, these themselves consequently being the documentaries of the achievements of the artists and the trends of arts in different ages. The images of cultdivinities and subsidiary deities (the latter generally occupying the niches of the outer faces of the temple-walls) have been found in profuse numbers.

Odisha with her five highly renowned Brahmanical *Khetras* (Saiva *Kshetra* of Bhubaneswar, Vaishnava *Kshetra* of Puri, Arka-*Kshetra* of Konark, Viraja-*Kshetra* of Jajpur and Vinayaka-*Kshetra)* has stamped on the popular mind its essentially Brahmanical associations. But a host of sites, particularly Ratnagiri and its two associated hill of Udayagiri and Lalitagiri, bring forward a long stretch of history when large segments of Odiyan people must have been permeated with the teachings of Sakyamuni. The mystery of Ratnagiri has now been clear with recent excavations. But other sites are still to reveal their secrets to the archaeologist's spade. Thus the archaeological wealth of the State is constituted not merely by Brahmanical temples, Buddhist and Jaina monuments contribute not a little to its richness.

The religious edifices are distributed throughout the length and breadth of the State. Indeed so numerous are the architectural and sculptural centres that it is impossible even to notice here all the leading centres of important sacred structures. I have to be extremely and perhaps arbitrarily selective in naming only a few of them in the following pages.

BHUBANESWAR

Bhubaneswar (District Khorda) commands the premier position among the archaeologically rich centres of Odisha by virtue of its majestic temples, the perfect symphony between their sculpture and architecture, the grand repertoire of their sculptural and architectural motifs and fine workmanship of their carvings. Known as Ekamra-Kshetra in ancient days, this Saiva *Kshetra* contains more than hundred temples of varying dimensions, which constitute practically the epitome of Kalinga architecture almost from its genesis to its culmination.

In typical Odiyan temple, the first two Orders form two component parts of one architectural scheme, viz., the sanctum with its surmounting curvilinear spire known as *rekha deul* (which creates the optical impression of one continuous line) and the frontal porch called *pida deul* because of its pyramidal roof made up of pidas. The Khakhara temples are distinguished by their semi-cylindrical roof which had its origin in the primitive huts. Five temples of this Order- (Vaital, Gauri, Bhubaneswari, Savitri and a tiny shrine within the enclosure of the Muktesyara) temple are now extant. All of these were intended for Sakti-worship-a fact difficult to explain away as a mere coincidence.

Among the many fully developed temples stands supreme the Lingaraja, one of the most finished and refined manifestation of the temple-architecture of India. Its plastic embellishment is in perfect concord with its soaring height and supreme architectural dignity. With all the architectural features (except the stylobate) fully developed, it sets the norm to follow for the later temples like the Ananta-Vasudeva (second half of the thirteenth century), Yamesvara and Sari Deul, the last three being burdened with an over-ornamentation. Among the *Rekha* temples, Rajarani, a rich combination of grace and elegance, is remarkable both for the unusual formation of its spire and sculptural embellishments.

UDAYAGIRI-KHANDAGIRI

One of the earliest group of Jaina rock-cut shelters, the caves of the twin sandstone hills of Udayagiri and Khandagiri (District Khorda), 8 km from Bhubaneswar, occupies an exalted position in the fields of history, architecture, art and Jaina iconography. The inscriptions found on the walls of the caves, which number nearly fifty, furnish the sole evidence of the existence of the Mahameghavahana family of the Chetis, the most powerful of this dynasty being Kharavela, who not only retrieved the undermined glory of Kalinga but also launched Kalinga on a career of conquest. From the evidence of the inscriptions of the reigns of the Bhauma-Karas and the Somavamsis and the sculptures, it is evident that Jain occupation of the hill was continuous, if with occasional breaks, from even before the time of Kharavela down to the present day.

Originally all the caves were excavated as dormitories, the fully developed ones consisting of one or multiple cells fronted by a common pillared verandah. Cave 1 (Rani-gumpha) of Udayagiri, the most elaborate and richly decorated double-storeyed gumpha, is further distinguished by the addition of two more wings, each in turn containing a suit of cells with a verandah. The sanctuary was a structural one but on the crest of Udayagiri. The date of the majority of the caves fall in the first century BC and AD. In a later period some of the caves of Khandagiri were converted into shrines by carving reliefs of tirthankaras and sasana-devatas.

HIRAPUR

This small squalid village, 7 km south-east of Bhubaneswar, has the rare distinction of having one of the very few Chausat-Yogini temples that India possesses. It is in the form of a circular hypaethral enclosure with a projected entrance. The inner face of the enclosure is provided with sixty niches, each containing a small chlorite image of a Yogini. At the centre of the enclosure is a tiny pavilion in the outer walls of which are fixed eight images, including four Yoginis. On either side of the passage leading to the inside is an emaciated awe-inspiring figure, possibly representing a Tantric Acharya. On the exterior face of the enclosure are nine large females, all standing on severed heads, and locally called Katyayanis. The Tantric character of the temple (ninth-tenth century) is thus unmistakable.

CHAURASI

Chaurasi (District Puri) on the bank of the Prachi was once a centre of temples, the most important temple being a Khakhara specimen, dedicated a Varahi. Despite its moderate dimensions this temples is of singular interest, having preserved all the original features.

Close to this temple lies a ten-armed image of Chamunda on a low mound, the later representing the debris of a temple.

Particularly beautiful is the sculpture representing Lakshmi and Narayana inside a dilapidated temple near the Varahi temple.

This very village yielded a copper-plate charter of Sivakara of the Bhauma-Kara dynasty of Odisha.

BEYALISHBATI

The beautiful Gangesvari temple of Beyalishbati (District Puri) consists of a *deul* of the *Khakhara* Order and a *jagamohana* of the full-fledged *Pida* Order. It is the only specimen so far known which represents the Khakhara type of this particular variety in its late phase. Stylistically and on considerations of iconography the temple is ascribable to the thirteenth century.

KONARK

Conceived by an architect of epic imagination at the instance of the Ganga king Narasimhadeva (1238-64) as a colossal chariot drawn on twelve pairs of exquisite wheels by a team of seven spirited horses, the temple of Konark (District Puri), dedicated to the illuminator of the world, is the supreme realization of the creative upsurge that fired the Odiyan architects since the seventh century. The overwhelming exuberance of sculptures and decorative patterns, boldly designed and executed with a consummate skill, vibrates with a rythm and grandeur rare in the world. Yet the plastic decoration is subordinated to architectural majesty and rather enhances the magnificence of the edifice as a whole. No doubt the builders of this sky-scraping temple 'built like Titans and finished like Jewellers'.

Affinity to a chariot ends with the wheels and horses. The rest of the edifice is the fullest manifestation of a typical Odiyan temple consisting of a *deul* of the *Rekha* Order and a *jagamohana* of the *Pida* type, with all the features fully evolved and executed on a titanic scale. Of unique conception are the female musicians, dancing ecstatically to musical measures, on the terraces of the *jagamohana*. Equally outstanding are the superbly executed horses and elephants which originally guarded the south and north stairs of the *jagamohana* and the chlorite *Aruna-Stambha*, the latter now gracing the main entrance of the Jagannatha temple of Puri.

In front of the *jagamohana* is a richly carved pillared structure, remarkable for the carnival of dance and musical performance depicted all over the structure.

To the south-west of this temple and dedicated again to the Sun-god is a smaller and slightly earlier sanctuary consisting of a *deul* and *jagamohana*. The plastic treatment of this temple too is impressive.

Further to the south-west is a small Vaishnava temple of bricks. Its three parsvadevatas, Varaha, Trivikrama and Narasimha, are now in the local sculpture-shed.

Besides these, threre are other structures including a kitchen, the entire complex enclosed by a compound-wall, the latter with two portals.

PURI

Puri, the great Vaishnava place of pilgrimage, is renowned for the sanctuary of Jagannatha, a temple of monumental magnitude built in the first half of the twelfth century by Anantavaraman Chodaganga. It consists of four structures, all in the same axial alignment, viz. *deul, jagamohana, natamandira* and *bhogamandap*, the last two being subsequent additions. The architectural effect of the *deul* and the *jagamohana,* is greatly undermined by modern restorations. The temple along with many others located in its courtyard is surrounded by two lines of enclosures. In front of the main portal has been planted the Aruna-stambha of Konark.

Of great artistic value is the group of large images of Matrikas, Virabhadra and Ganesa found inside a shrine on the Markandesvara tank.

The Atharanala bridge over the Mutianadi of Madhupur is an old specimen built on the principle of horizontal corbelling.

SIMHANATH ISLAND NEAR RAMESWAR

The Simhanatha Siva temple in an island (District Cuttack) of the Mahanadi near the recorded mauza Rameswar bears a striking resemblance to the Parasuramesvara temple of Bhubaneswar not only in general contour but also in details of carving and thus belongs to the early period of the architectural movement in Odisha. The carvings are charmingly elegant, bespeaking considerable skill of the sculptor. Particularly remarkable is a host of deities of the Saiva, Vaishnava and Sakta cults, depicted on the exterior walls. These figures are characterized by a soft plasticity of modelling and perfect equipose reminiscent of the late Gupta tradition.

RATNAGIRI

Recent excavations on the top of Ratnagiri (District Cuttack) not far from the junction of Birupa and Brahmani, have unearthed one of the most important Buddhist establishments.

Four seasons excavations have now laid bare the complete remains of an impressive stupa, rebuilt twice, two magnificent monasteries, also rebuilt more than once, six temples, more than thousand small stupas, myriads of sculptures and architectural pieces, objects of daily use and hundreds of other evidences of what life was like in these monasteries. Indeed these excavations have revealed that here was an establishment that can be compared with Nalanda.

UDAYAGIRI

The potentiality of the site of Udayagiri on the Birupa, very near to Ratnagiri, is amply attested not only by a host of beautiful Buddhist images found of the surface but also by a number of impressive mounds, which, after excavation, will no doubt, yield stupas, monasteries and temples. One of the quadrangular mounds presents the appearance of a monastery. A partially exposed cell of the latter looks like the chapel of the monastery, as against its back wall is found an image of Buddha. The richly carved door-frame, which has been removed to the Patna Museum, possible belonged to this very monastery. A partly exposed impressive stupa of bricks has two images of Buddha fixed on its faces. There are a few rock cut Buddhist reliefs on the higher reaches of the hill, besides an impressive rock-cut stepped well at the foot of the hill. Many of the sculptures from this centre are now displayed in the Indian Museum and Patna Museum.

LALITAGIRI

The Buddhist ruins of Lalitgiri, near Udayagiri, are even more extensive. But except some images and a carved door-frame they are all buried beneath the accumulations of debris. The site has been considerably despoiled by the local people and many of the images have been removed by the former Zamindars. Some of the images have found their way to the Indian Museum, Bhubaneswar Museum and Museeo Guimet (Paris). Still there are more than thirty large sculptures, including a colossal image of Buddha, at the site.

JAJPUR

As the flourishing capital of the Bhaumas and Somavamsis, Jajpur district, the ancient Yayatinagara on the Baitarani, was once adorned with many edifices which, however, succumbed to the fury of the Muslim conquerors. Not a single early temple exists intact now. Even the present temple of Viraja, the presiding deity of this *kshetra*, is a comparatively modern one. But from the myriads of images and architectural pieces (ranging in date from the seventh century to the fifteenth century), lying within the precincts of the modern temples, road-sides, fields and even in the houses of the local people one can easily visualize the past glory of this ancient capital with sacred structures of various creeds. A majority of these sculptures represent different forms of Sakti, which is but natural in a Sakta *kshetra*. Of great antiquarian interest are the boldly executed colossal chlorite images of indrani, Varahi and Chamunda besides a set of matrika-images in a modern shrine on the Dasasvamedhaghat of the Baitarani. Images of other creeds, Vaishnava, Saiva, Saura, Ganapatya, Jaina and Buddhist are also not very rare. A colossal image of Padmapani, now laying in the compound of the S.D.O., is the largest Buddhist sculpture so far found in Odisha.

SOLAMPUR

The present village of Solampur (District Balasore) on the Baitarani opposite Jajpur, stands on the ruins of an extensive Buddhist establishment. The latter most probably represents the Salonapura-mahavihara mentioned in the Ratnagiri plates of Karna. As many as twenty-five Buddhist sculptures, some with inscriptions, were seen by the writer at the site, which, if subjected to the spade, will no doubt yield substantial remains of Buddhist edifices.

AJODHYA

Ajodhya (District Balasore) is exceptionally rich in Buddhist and Jaina sculpture (mostly of the ninth-tenth century) which have been laid bare during sporadic diggings by the villagers. The present habitation itself is located on the mounds containing the remains of the Buddhist and Jaina structures. A beautiful image of Marichi is now in worship inside a modern temple.

KHICHING

Khiching (District Mayurbhanj), the ancient capital Khijinga of the Bhanjas, is better known for its Brahmanical temples, though it once nourished a flourishing Buddhist establishment. A few Jain sculptures have also been picked up from the site.

The focus of the centre was Panchayatana temple of Siva, made of greenish stone, of which only the one (Chandrasekhara Mahadeva temple) at the south-western corner of the extinct main temple has survived to a considerable extent. At the very spot of the main temple has been erected by the former Mayurbhanj State a temple by assiduously and cleverly assembling the architectural fragments of old temples and using modern material wherever old pieces could not be found, a classic example of such attempts. The carved exterior of this reconstructed temple is one of the most splendid of its kind. Equally arresting is the rich collection of sculptures (including the colossal image of Siva, the original presiding deity of the central temple), found in the compound of the Panchayatana temple.

SITABINJI

Sitabinji (District Keonjhar) is celebrated for an early painting depicting a royal procession, an unique specimen in Odisha. Of great artistic excellence, this painting further bears on it the name of Maharaja Disabhanja, written in the characters of about the fifth-sixth century AD. The high antiquity of the site, however, is established by a large number of microliths and some neoliths.

RANIPUR-JHARIAL

Ranipur-Jharial (District Bolangir) is justly famous for its rich heritage in the form of scores of temples. The majority of them are located on a low granite outcrop. Most of these temples are of *Rekha* Order, one of them (Somesvara temple) bearing an inscription in the characters of about the eleventh century. Two of these temples are of the *Khakhara* Order. The most important of the group, however, is a large hypaethral circular temple of the Chausat-Yoginis. At the centre of its enclosure is a small pillared mandapa with a large image of dancing Siva.

Of the monuments located outside the outcrop, an ornate brick temple of considerable height and several rock-cut reliefs particularly deserve notice.

BAIDYANATH

Baidyanath (District Bolangir) on the bank of the Tel has two beautiful temples of outstanding importance. Of them, the pillared mandapa of the Kosalesvara temple is of particular significance not only for the large sculptures that adorn the interior walls but also for its architectural peculiarities with lateral transepts which bear no affinity with the typical *jagamohanas* of Odisha. The source of its inspiration is evidently central India.

GANDHARADI

The twin temples of Nilamadhava (Vishnu) and Siddhesvara Siva at Gandharadi (District Phulbani) are fine specimens of the mature phase of the early type of *Rekha Deuls*. Their oblong *jagamohanas,* with the terraced roof sloping in two stages, are affiliated to the porch of the Parasuramesvara at Bhubaneswar. The surface-treatment of both the temples is remarkably rich.

BAUDH

Of the monuments of Baudh Town, three temples within the compound of Ramesvara temple and the remains of partly excavated Buddhist monastery are of singular interest. All the temples with their rich texture and carved surface are arresting. Added to these, is their unique ground-plan in the shape of a star. The image of Buddha in the chapel of the quadrangular brick monastery is quite impressive.

KUALO

Of the Panchayatana class, the Kanakesvara temple at Kualo (District Dhenkanal) forms an attractive composition on account of the effective arrangement of the central and accessory sanctuaries. In the essential features of elevation and elegant ornamentation, it bears a close affinity to the Sisiresvara temple of Bhubaneswar. The Central temple, the highest one among the temples of the early phase of the Kalinga architecture, is now almost dilapidated. But enough remains to demonstrate the rich character of the embellishments.

SARANG

The titanic rock-cut image (46 ft. 9 ins. long) of Anantasayan Vishnu on the bed of the Brahmani near Sarang (District Dhenkanal) is not only magnificent in conception, but also the largest image of Odisha.

RASOL

A slightly smaller version (42 ft. long) of Anantasayan Vishnu of Sarang may be seen near a field at Rasol (District Dhenkanal).

BAJRAKOT

The Bhringesvara Mahadeva temple at Bajrakot (District Dhenkanal) is an excellent specimen of the early phase of the *Rekha* Order. Its sculptures and reliefs in their beauty of form and in the refinement of ornamentation, display a classic dignity. This temple as well as the Kanakesvara temple pertain to one conception, expressive of one period.

According to Dr. Suniti Kumar Chatterjee, "The culture of India is a single unit, like a fully-blown lotus flower, and the various petals of the flower are the local variations of the common Indian culture which developed in the different areas of the country. The Art of India, for example, is one and unique, but there are local variations of this art, which make for all the beauty in variety of Indian sculpture as a whole. There is no mistake about a master-piece of sculpture from Bhubaneswara in Odisha, as much as one cannot mistake the character and provenance of a piece of sculpture from Tamil-Nadu or Karnataka, Bengal or Rajasthan"...

CONTRIBUTION TO THE GROWTH OF INDIAN CULTURE

Indian culture is such a wide term that it is understood differently by different sections of the Indian community. A typical example will explain what I mean. It can be safely said by a large section of the community that beef-eating is something, which is foreign to Indian culture. But there are other sections in the society, which are mostly tribal, who consider beef-eating as an act of virtue, while they look upon the drinking of milk as an inconceivably wrong act. Since full-fledged democracy has been introduced and each citizen, irrespective of his caste, creed or religion, has been given the right of franchise, I do not think any section can put forth its own beliefs as constituting Indian culture. The sooner this is realised, the better for the consolidation of India.

Briefly, the history of Indian culture is that as many as four different civilisations rolled one upon another in the course of the past thousands of years and ultimately bifurcated into two main trends of culture; one is the Aryan and the other is the Pre-Aryan. Our epics, the Ramayana and the Mahabharata, describe conflicts and conquests amongst different tribes and sections and have laid emphasis on the predominance of the Aryan culture over the other one. These epics are, however, of a later period. It was Buddha, who made the first organised effort to introduce a mass religion in India which would be accepted by all, irrespective of whatever differences they might have inherited from the past. In fact, at this distance of time, we might look upon Buddha as the symbol of Indian unity and culture, who did his utmost during his lifetime to propagate the religion of tolerance and compassion. But it so happened, probably on account of reaction, that Buddha's teaching could not be so widespread for about three centuries after his death. It was left to Ashoka, the great monarch who renounced war as a method of conquest of people in this State of Odisha, which was then known as Kalinga, to make a systematic drive to bring about synthesis of cultures. If the inscriptions of Ashoka are carefully analysed, it will be seen with great surprise that the great monarch, who was converted into Buddhism, did not make any mention regarding spread of that particular religion. On the contrary, in every inscription Ashoka has referred both to the Brahmanas and the Srahmanas on equal terms. His effort was directed only to bring all people to the path of Saddharma; i.e. true civilisation. He asked his officers to go and teach the general people as to how they should behave among themselves. He laid stress on conduct rather than on any special dogma. In his special Kalinga edict, he asked his officers to reply, when they would be questioned about the attitude of the monarch towards the tribal people, that the King looked upon these people as his own children. This message of love inscribed on the hills of Dhauli and Jaugarh rings in our ears even today with the same force as it did ages ago. That was the message which must be said was the basis of Indian culture.

Mutual tolerance, recognition of the ways of life of various sections subject to the rules of conduct prescribed by Ashoka, are the ingredients of Indian culture. In the course of the last 2,000 years, this process of integration of cultures, started with missionary zeal by Ashoka, has received serious set-backs now and then. But the fundamentals have gone down from generation to generation as the guiding principle of all religions. It is an accident that the process of integration, following upon the conversion of Ashoka, started in Odisha. Was there anything special in this part of India which was responsible for this epoch making event ? It is true that the people of Kalinga fought bravely to the last man and fell mercilessly slain on the battle field. The determination and the courage of the people of Kalinga might have been a factor to create an impression on the mind of Ashoka. Nothing more than this can be said at this distance of time. The fact, however, remains that the missionary work of tolerance and good conduct, which subsequently dominated Indian culture, started in Odisha.

There have been reactions here and there in many sections against the broad principles of mutual tolerance and good behaviour. But somehow it has so happened that in this particular region of the country, accommodation of various religious sects, which came into existence in the course of the past thousands of years, went on in such a manner that today no temple in Odisha can legitimately claim to belong to any particular sect. The two main temples of Puri and Bhubaneswar have in them both Brahmin and non-Brahmin priests. In fact in the villages, the priests serving the village deities are mostly non-Brahmins and tribal people. The process of integration went on to such an extent that large sections of tribal people have got inter-mingled with the other sections in an inextricable manner.

The tribal problem, as it is understood in some other parts of India, is not the same here in Odisha. Here, intermarriage between those who are enlisted as scheduled tribes in the voters list and those who are described as general voters, takes place with ease as a matter of course. The Brahmins work as priests in the houses of tribal landlords. In fact, in a large tract of this state, one would notice the absence of acute divergence between tribals and non-tribals witnessed in some other parts of India. In the course of centuries, Odisha has produced a deity, Jagannath, who has assimilated in himself all sects, which have been responsible for creating acute cleavage in other places.

Coming back to the epics, it must be realised that these are not popular amongst the tribal section. Effort is being made in some parts of India to introduce these epics amongst the tribal people in their own languages. But as far as I have understood the mind of the tribal people, I do not think, that effort will be crowned with success. The effort, I suggest, should be to re-write these epics with a master hand, changing the emphasis from conflicts and conquests to mutual tolerance and recognition of the ways of life of all sections in India, however, small they may be. Unfortunately, the British historians depicted our tribal peoples as aborigines, thus giving an impression that these tribes have no civilisation of their own. But the fact is that all the tribes in India are highly civilised in their own way and have their own way of life, which is not very much different from that of those who consider themselves superior. For the growth of Indian culture, it is necessary to change the outlook and attitude towards those ways of life, which are different from the Aryan one. I have no doubt that in course of time, this truth will be realised by all and the process, which was started by Ashoka in Odisha, will be completed.

THE CULT OF JAGANNATH

The religious life of Odisha is inextricably bound up today with Jagannath of Puri. For the people of Odisha, Jagannath is the manifestation of the Supreme Being. There have been from time to time revolutionary changes in the popular religion of the country; Buddhism, Jainism, Shaivism and Vaishnavism all have exercised a strong influence on the religious beliefs of the people. Sometimes royal patronage has lent support to one particular cult or another, but the glory of Jagannath continues undiminished as ever. The history of the religion of the Odiya people is, so to speak, the history of Jagannath. Jagannath (Lord of the Universe) is an attribute of Vishnu and Jagannath has been used as another name for Vishnu, but nowhere in the ancient scriptures has Jagannath been spoken of as one of the manifestations of Vishnu. It is beyond our comprehension how the name of Krishna-Vasudeva was replaced by that of Jagannath.

We can probably account for the name of Jagannath and the existence of Subhadra with him in the following manner :–

There were three images in very ancient times. The chief of them was known as Jagannath and the image between the two was considered a female deity. It was further conceived that she was the sister of the other two. When the worship of Krishna-Vasudeva was gaining ground in the eastern and southern India, the image of Jagannath, which had been existing from a very long time, was taken to stand for Krishna and the other male deity, as a matter of course, was called Balarama and the female deity, who had been considered the sister of the two, was called Subhadra. It is likely that, at the time when Jagannath was considered to stand for Krishna, a Sakti for each god had not been conceived. But by the time a female deity came to be considered as the Sakti of each god, the name of Jagannath had been so firmly established that it was not possible to change it into any other. Thus the names of the deities remained as Jagannath, Balabhadra and Subhadra.

There is little evidence in Odisha to show how the worship of Krishna-Vasudeva gradually lost itself in the worship of Gopalkrishna, which ultimately culminated in that of Radha Krishna. If Jagannath had been established from the very beginning as Krishna-Vasudeva, the identification of Krishna-Vasudeva with Gopalkrishna and subsequently his association with Radha, must have found expression in Jagannath and in the forms of his worship. Until the end of the 14th century, there is no trace of these changes in Odisha except that Baladeva and Subhadra were seated with Jagannath in the same temple.

There are different traditions relating to the origin of Jagannath. It is said that when Sri Krishna left the world, his earthly remains were placed on the funeral pyre but the navel portion could not be consumed by fire. So it was floated down in the sea. It reached Nilachala (Puri). At this time, King Indradyumna was practising austerities to have a view of Vishnu, who appeared before him in a vision and ordered him to place this navel portion in a wooden image and worship it as Vishnu. Nilambaradasa (15th century) describes the construction of the temple of Jagannath in his book on the construction of the temple named *Deulatola* in the following manner. Narada informed Indradyumna, King of Malaya, that Nila-Madhava was on the shore of the Eastern Sea. Indradyumna deputed his minister Vidyapati to enquire after Nila Madhaba. Vidyapati came to Nilachala and learnt that a Savara, Visvavasu by name, had secreted Nila-Madhava and allowed no one else to visit the deity, Vidyapati managed to get himself admitted as a guest into Visvavasu's palace where he fell in love with his daughter. With her help, Vidyapati found out where Nila-Madhava was and sent word to Indradyumna, who proceeded to Odisha with a huge army. Visvavasu met Indradyumna at Charchika near Banki and submitted to him. They became friends, but in the meantime, Nila-Madhava had vanished. Indradyumna gave up food and practised severe austerities for 21 days, after which a divine voice told him in dream that Nila-Madhava had taken the form of Daru (a log of wood) and was floating in the sea. He was further advised to get the image of Nila-Madhava made out of this Daru and worship it. Viswakarma, the divine architect, appeared before King Indradyumna in the guise of an old carpenter and undertook the construction of the image on condition that the doors of the room where he would work would remain closed for a fixed period. The work went on but after some days, Gundicha, the queen of Indradyumna, got curious and caused the doors to be opened. It was found that the old carpenter had vanished and there were the three half-done images. These images are still being worshipped.

The following version of the story of Jagannath is to be found in the Vana Parva and the Mushali Parva of Saraladasa's Odiya Mahabharata. When Sri Krishna was killed by the arrow of Jara, a fowler, Arjuna tried to burn the dead body but he failed to do so. Consequently, it was thrown into the sea. At length, it floated in the form of a Daru (a log of wood) to Nilasundara (Puri) on the shores of the sea. Jara had followed the dead body along the sea coast. Indradyumna, son of King Galamadhava, constructed a temple and installed the images constructed by Viswakarma in disguise. In this version also, the uncouth figures are ascribed to the opening of the doors before the stipulated period.

In the 16th century when neo-Vaishnavism, or the cult of love, was introduced in Odisha through Sri Chaitanya and his followers, it was also absorbed into this cult of Jagannath and Jagannath came to be regarded as the chief deity of neo-Vaishnavism.

AREA AND POPULATION (TABLE - 1)

Area, density and decadal growth rate of population, Sub-division, Tahsil and Development Blocks in different districts of Odisha.

Sl. No.	Name of the District/State	Geographical Area in sq.kms	Total Population		Decadal growth rate over 2001 1991	Density per sq. k.m. 2001 census	sub Division	Tahsil	Dev. Blocks
			1991 Census	2001 Census					
1	2	3	4	5	6	7	8	9	10
1	Angul	6375	961037	114003	18.62	179	4	5	8
2	Balasore	3806	1696583	2024508	19.33	532	2	7	12
3	Baragarh	5837	1207172	1346336	11.53	231	2	8	12
4	Bhadrak	2505	1105834	1333749	20.61	532	1	6	7
5	Bolangir	6575	1230938	1337194	8.63	203	3	6	14
6	Boudh	3098	317622	373372	17.55	121	1	2	3
7	Cuttack	3932	2053192	2341094	14.02	595	3	11	14
8	Deogarh	2940	234238	274108	17.02	93	1	1	3
9	Dhenkanal	4452	947870	1066878	12.56	240	3	6	8
10	Gajapati	4325	454708	518837	14.10	120	1	3	7
11	Ganjam	8206	2704056	3160635	16.88	385	3	14	22
12	Jagatsinghpur	1668	933789	1057629	13.26	633	1	4	8
13	Jajpur	2899	1386177	1624341	17.18	560	1	6	10
14	Jharsuguda	2081	442154	509716	15.28	245	1	2	5
15	Kalahandi	7920	1130903	1335494	18.09	169	2	7	13
16	Kandhamal	8021	546281	648201	18.66	81	2	4	12
17	Kendrapara	2644	1149501	1302005	13.25	492	1	7	9
18	Keonjhar	8303	1337026	1561990	16.79	188	3	8	13
19	Khurda	2813	1502014	1877395	24.79	666	2	7	10
20	Koraput	8807	1029577	1180635	14.41	134	2	7	14
21	Malkangiri	5791	422326	504198	19.39	87	1	3	7
22	Mayurbhanj	10418	1884580	2223456	17.89	213	4	9	26
23	Nabarangpur	5291	846659	1025766	21.15	194	1	4	10
24	Nayagarh	3890	782647	864516	10.39	222	1	4	8
25	Nuapada	3852	469482	530690	13.00	138	1	2	5
26	Puri	3479	1305365	1502682	15.52	432	1	7	11
27	Rayagada	7073	713984	831109	16.40	118	2	4	11
28	Sambalpur	6657	813589	935613	15.00	141	3	4	9
29	Subarnapur	2337	476815	541835	13.64	232	2	4	6
30	Sundargarh	9712	1573617	1830673	16.26	118	3.	9	17
	ODISHA	**155707**	**31659736**	**36804660**	**16.25**	**236**	**58**	**171**	**314**

Source : *Statiscal Abstract of Odisha – 2008*

Sl No.	Name of the District / State	2011 Census (P)		Decadal Growth Rate 2001 to 2011	Literacy rate (2011 Census (P))	
		Males	Females		Males	Females
1	Angul	654898	616805	11.55	87.06	70.44
2	Balasore	1184371	1133048	14.47	86.06	72.95
3	Bargarh	748332	730501	9.84	84.28	65.84
4	Bhadrak	760591	745931	12.95	89.92	76.49
5	Bolangir	831349	817225	23.29	77.08	53.77
6	Boudh	220993	218924	17.82	84.49	60.44
7	Cuttack	1339153	1279555	11.87	90.51	77.64
8	Deogarh	158017	154147	13.88	82.62	63.36
9	Dhenkanal	612597	580351	11.82	87.08	71.40
10	Gajapati	282041	293839	10.99	65.58	43.59
11	Ganjam	1777324	1742827	11.37	81.85	61.84
12	Jagatsingpur	577699	558905	7.44	93.20	80.88
13	Jajpur	926058	900217	12.43	87.36	73.37
14	Jharsuguda	297014	282485	12.56	86.27	70.05
15	Kalahandi	785179	787875	17.79	73.34	47.27
16	Kandhamal	359401	372551	12.92	78.41	52.56
17	Kendrapara	717695	722196	10.59	92.45	79.51
18	Keonjhar	907135	895642	15.42	79.22	58.70
19	Khurda	1166949	1079392	19.65	92.55	82.06
20	Koraput	677864	699070	16.63	61.29	38.92
21	Malkangiri	303913	308814	21.53	60.29	38.95
22	Mayurbhanj	1253633	1260262	13.06	74.92	53.18
23	Nabarangpur	604046	614716	18.81	59.45	37.22
24	Nayagarh	502194	460021	11.30	86.63	71.08
25	Nuapada	300307	306183	14.28	71.55	45.21
26	Puri	865209	832774	13.00	91.84	78.67
27	Rayagada	469672	492287	15.74	62.61	39.87
28	Sambalpur	529424	514986	12.24	85.17	68.47
29	Subarnapur	332897	319210	20.35	84.78	63.63
30	Sundargarh	1055723	1024941	13.66	82.13	65.93
	ODISHA	**21201678**	**20745680**	**13.97**	**82.40**	**64.36**

Max

Source *: Census India – 2011 (P)*

Since Odisha happens to be one of the most ancient regions of India and since it has so happened that the waves of various cultures have passed over this part of India in such a manner without one ousting the other but all becoming integrated in a synthetic way, Odisha has all along been the cultural epitome of India.

SOCIO ECONOMIC BACKDROP

Odisha comprises of 4.74% of India's landmass. The Decadal Growth Rate from 2001 to 2011 of population was 13.97% as per 2011 Census (P). Odisha's economy passes through a transformation from "a growing economy" to "an economy at take off stage". Pace of industrialization continues in high note. Continuous improvement in "ease of doing business" has further stimulated the process. Human development indications have improved. Mining is a core sector for the state because of vast mineral resources of the state. Out of 314 development blocks, irrigation coverage in 198 blocks is less than 35 percent of the cultivable area. The schemes such as AIBP, RIDF, JBIC, RSVY, NREGS, WODC, FFW are being implemented to achieve desired objectives. With a road density of 178 km. of road per 100 sq. km of area, Odisha is ahead of all India average of 159 km. per 100 sq. km of area. Railway density of Odisha is 16 km per thousand square km of area, which is below the national average of 20 km. Developmental expenditure covering the social and economic sectors is now about 75% of total expenditure and the overall fiscal situation of Odisha is stable.

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THALLPATHY7

2

GEOLOGICAL EVOLUTION AND STRUCTURAL DIVISIONS

- Stratigraphic Succession of Odisha
- Gondwana basins of Odisha

Geology deals with the origin, composition and history of the earth. The various stages of earths history are classified by using terms for division of time and/or terms applying to strata accumulated during various periods. The 'time term' are era, period, epoch and stage. Their corresponding 'strata terms' are group, system, series, stages or formation.

The Odisha State has a prominent precambrian terrain and embraces a vast time span from about 4,000 million years to 600 million years. It occupies about 80% of the land surface of the state.

The middle part of which shows a narrow tract of the Gondwana rocks that stretches almost east-west from Talcher to Hingir and is regarded as the Gondwana deposits of the Mahanadi Valley of Odisha.

The only rocks of Tertiary cropping out namely the "Baripada beds" have very limited spread out, within a radius of 8 km. around Baripada in Mayurbhanj district. (See Map No. 1 Geological map of Odisha after Mahalik, 1995.)

The geological history of all the eras of the earth has been recorded to some extent in Odisha. Forming a part of the north-eastern extension of the peninsular shield, Odisha is by and large underlain by Precambrian rocks. About 20 per cent of the total area of the state is constituted of the Phanerozoic rocks, Quaternary formation and Recent to sub-Recent alluvium. These latter are chiefly confined to the coastal tracts of the state.

The Precambrian rocks are mostly metasediments and occur as dissected patches separated by vast stretches of granites, ortho and para-gneisses, migmatites, charnockites, basic and ultrabasic intrusives and effusive mafic rocks (Mahalik, 1995).

The Phanerozoic rocks of Odisha are represented by the Gondwana Super-Group encompassing Upper Palaeozoic to Middle Mesozoic and the Baripada Beds of Lower Tertiary. The Gondwana of Odisha in a broad sense are of non-marine continental deposits and the Lower Tertiary rocks indicate a marine environment. But as per the recent work of De (2001), the ichnological evidences argue in favour of a paralic (coastal marine to deltaic) mode of origin of the Gondwana coal beds and associated sediments.

The stratigraphy of the different groups of rocks of Odisha is shown in followi Table. In the stratigraphic-tectonic classification of the Precambrians of Odisha, an attempt h been made to follow the main principles formulated by Salop (1972,1977).

STRATIGRAPHIC SUCCESSION OF ODISHA

Subdivisions recognised in Odisha.	**Classification Iyengar & Banerjee (1971)**	**Salop (1972)**	**Equivalents in other parts of the country**
Coastal alluvial cover	Recent to Quaternary		
Baripada Beds	Miocene		
Gondwana Super-group	Upper Palaeozoic to Middle Mesozoic		
Vindhyan Platform cover	Riphean or Vendian (less than 600 m.y.)	Epiproterozoic to Eocambrian	Chhattisgarh Basin and Indravati Series in M.P.
Gangpur Singhbhum Group	Riphean (600-1400 m.y.)	Neoproterozoic	Sausar Group of M.P.
Kolhan Group	Pre-Riphean to Riphean (?) (1500-1600 m.y.)		
Koira-Simlipal Group	Pre-Riphean (1400-3000 m.y.)	Mesoproterozoic	(?) Sakolis of M.
Iron Ore Group	Pre-Riphean (1400-300 m.y.)	Palaeo-Proterozoic	Bengpal-Bailadila of M.P., Nellore belt of A.P. Dharwars of Karnatak.
Eastern Ghats Group	Pre-Riphean (1400-3000 m.y.)	Archean	Granulite rocks of Kerala and Nilgiri hills.

GONDWANA BASINS OF ODISHA

(i) Distribution : The Gondwana rocks occupy an area of about 12,400 sq. km. in Odisha. Their basin-wise distribution is as follows :

Sl. No.	Basin/Outlier	District	Geological Age
1.	Talcher Basin	Angul/Dhenkanal	Upper Carboniferous-Triassic (300-200 m.y.)
2.	Ib-River Basin	Sambalpur/Sundargarh Jharsuguda	Upper Carboniferous-Triassic (300-200 m.y.)
3.	Katringia Outlier	Phulbani/Baudh	Upper Carboniferous-Permian (330-275 m.y.)
4.	Salebhatta Outlier	Bolangir/Sambalpur	Upper Carboniferous-Permian (330-275 m.y.)
5.	Athmallik Outlier	Angul/Phulbani/Baudh	Upper Carboniferous-Permian (330-275 m.y.)
6.	Athgarh Basin	Cuttack/Khurda	Lower Cretaceous (140 m.y.)
7.	Chhatrapur	Ganjam/Puri	Lower Cretaceous (140 m.y.)

(ii) Stratigraphy : The stratigraphic set up of the Gondwana group of Odisha can be given as follows (After Pandya, 1995) :

Age	Formation	Lithology	Area
Lower Cretaceous (Upper Gondwana)	Athgarh	Conglomerate, Sandstone, Shale, Fireclay	Athragh Basin Ganjam (?)
Permo-Triassic (Middle Gondwana)	Kamthi	Conglomerate, Shale, Ferruginous Sandstone	Talcher and Ib-River Basin
Permo-Carboniferous (Lower Gondwana)	Barakar	Sandstone, Shale and Coal,	Talcher, Phulbani, Athmalik, Ib-River Basin
	Karharbari	Sandstone, Shale and Coal,	
	Talcher	Boulder bed, green Shale, Sandstone, Marl,	

— — — — — — — — — — — — — Unconformity — — — — — — — — — — — — — —

Precambrians

(iii) Lithology : The various Gondwana formations were deposited at different geological times under widely varying climatic and environmental conditions exhibiting striking dissimilarity in their lithology in various basins and outliers of this state. The gross lithology of the formations can be described in the next page :

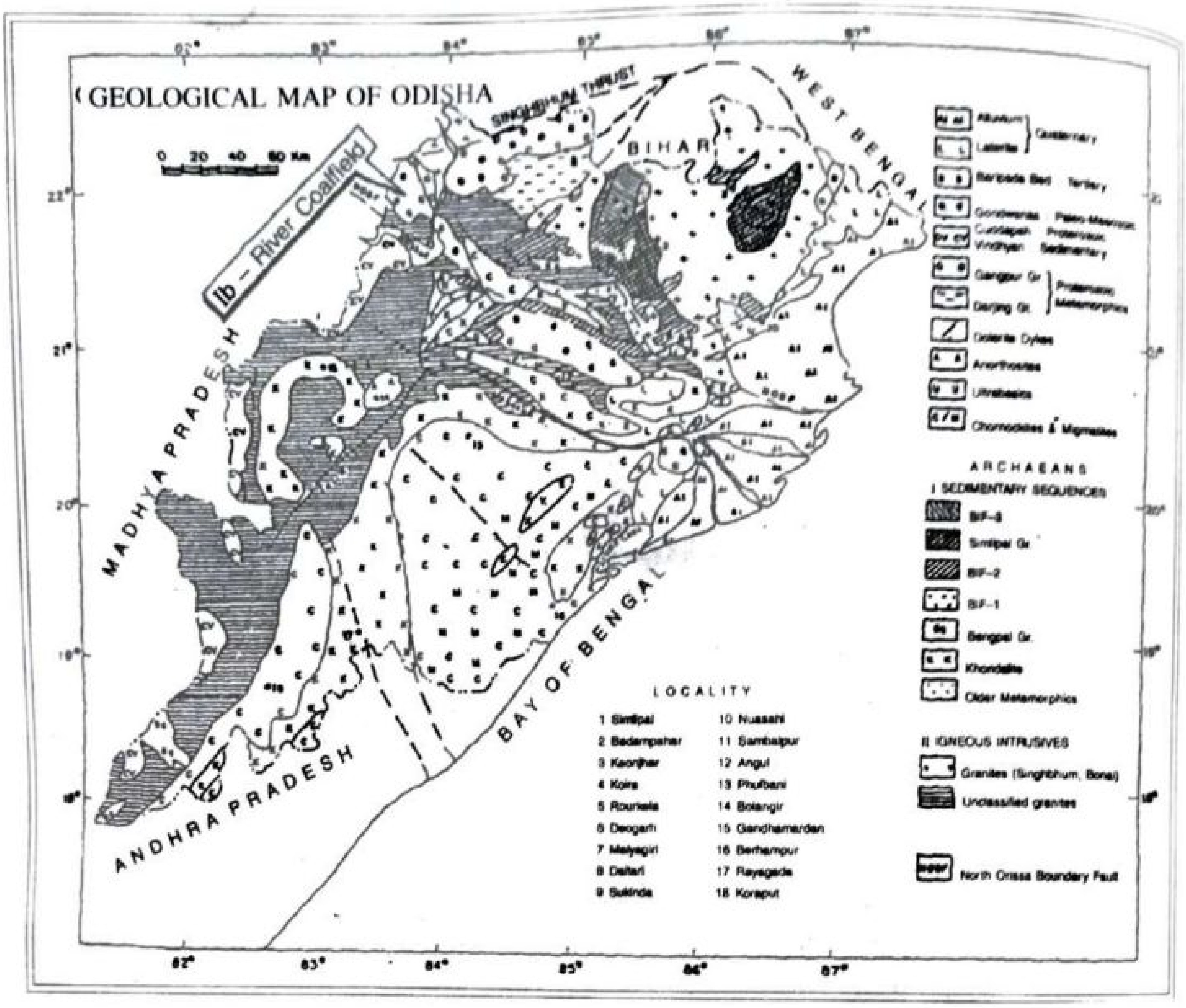
GEOLOGICAL MAP OF ODISHA
0 20 40 60 Km
Ib – River Coalfield
SINGHBHUM THRUST
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°
Alluvium
Laterite
Quaternary
Baripada Bed Tertiary
Gondwanas Paleo-Mesozoic
Cuddapah Proterozoic
Vindhyan Sedimentary
Gangpur Gr.
Darjing Gr.
Proterozoic Metamorphics
Dolerite Dykes
Anorthosites
Ultrabasics
Charnockites & Migmatites
ARCHAEANS
I SEDIMENTARY SEQUENCES
BIF-3
Simlipal Gr.
BIF-2
BIF-1
Bengpal Gr.
Khondalite
Older Metamorphics
II IGNEOUS INTRUSIVES
Granites (Singhbhum, Bonai)
Unclassified granites
North Orissa Boundary Fault
LOCALITY
1 Similipal
2 Badampahar
3 Keonjhar
4 Koira
5 Rourkela
6 Deogarh
7 Malyagiri
8 Daitari
9 Sukinda
10 Nuasahi
11 Sambalpur
12 Angul
13 Phulbani
14 Bolangir
15 Gandhamardan
16 Berhampur
17 Rayagada
18 Koraput

Fig.1 (After N.K.Mahalik, 1995)

Talcher Formation

In the type area of Talcher Basin, the basal Gondwana boulder bed and coarse sandstone inter-bedded with shale, siltstone, marl and some stromatolitic limestone collectively measure 280 metres in thickness (Pandya, 1987, 1990). The Ib-River succession is 130 metres thick, comprising fine and greenish, ripple-laminated sandstone (Raja Rao, 1982). They occur as continuous strip at the fringes of both the basins. Occurrences of these rocks extending south easterly from Ib-River Basin to Talcher Basin have been recorded. Outliers exist at Phulbani, Athmallik and Bolangir also.

Karharbari Formation

Attaining a thickness of 270 metres in Talcher and 90-125 metres in Ib-River sections, the Karharbaris conformably overlie the Talchers and are composed of fine grained micaceous sandstone; cross-bedded arkosic sandstone; coarse, pebbly, ferruginous feldspathic sandstone and lenses of conglomerate (Das and Rath, 1974; Das 1994).

Barakar Formation

It is the main coal-bearing horizon in Odisha. The Barakars have attained a thickness of 500 metres in Talcher Basin and 600 metres in Ib-River Basin. Graded bedding of the chiefly arenite sequence demonstrates deposition of cyclothems, each terminating with shale, carbonaceous shale and coal seams. Talcher recorded 10 cycles while the Ib-River Basin hosts 5 coal seams in Rampur Sub-basin and 3 seams in Hingir Sub-basin. Boulder beds composed of boulders, gravels, cobbles of quartz and quartzite characterise the basal part of the formation. Presence of carbonaceous shale in the outliers of Phulbani, Bolangir and Athmallik has been indicated.

Kamthi Formation

A thick sequence of conglomerate, sandstone and shale overlying Barakars are grouped together as the Kamthis. These have thickness of 250 to 300 metres. The members extend from Permian to Triassic in age (Raja Rao, 1982).

Athgarh Formation

Comprising dominantly of sandstones classified as quartz arenite, sublithic arenite, lithic arenite and lithic wackes (Mishra, 1988; Pal, 1990) characteristically lacking in feldspars in the classic components. Athgarhs attain thickness of upto 400 metres and include conglomerates, grits, carbonaceous shale, variegated shale and fireclay; most of them as small lenticulars, breaking the monotonous vastness of sandstone. Only at Naraj, a dolerite intrusive (109 + 26 m.y. by K-Ar method; Agrawal and Rama, 1976) punctuates the near homogeneous rock exposures. The sandstones have a typical laterite profile up to a level of 60 metres above the M.S.L. A Palynology study in splintery khaki-green shale from Garh Haldia, underlying Athgarh sandstone indicates a Lower Gondwana age (Tiwari *et at,* 1987).

(iv) Structure : The Gondwana sediments of Talcher and Ib-River Basins were deposited in the Satpura-Mahanadi Graben, defined by pronounced NW-SE trending lineaments on a Precambrian Platform, almost separating the Eastern Ghat Mobile Belt and North Odisha Craton (Mahalik, 1994). The northern and southern boundaries of the two basins are faulted and the sediments appear to have been preserved in the troughs.

On a regional scale, Talcher Basin takes the shape of a north westerly plunging syncline with closure in the east and the younger horizons outcropping progressively towards west (Raja Rao, 1982). On the other hand, the beds dip northerly and number of coal seams increase in that direction, indicating a possible homoclinal structure.

Three sets of intra-basinal faults trending E-W, NE-SW and WNW-ESW have been recognised. The Ib-River Basin, which consists of three sub-basins, viz., Rampur, Hingir and Talbira, has been affected by two sets of intrabasinal faults trending NW-SE and E-W.

The younger Athgarh Formation rests unconformably over Eastern Ghat granulites with a dip of 3°-10° to S and SE directions. The Gondwana sediments of Phulbani, Athmallik and Bolangir also rest unconformably over Precambrian basement.

(v) Climate and Sedimentation : The earliest period of glaciation as interpreted with the Talcher boulder bed (Blanford *et at.* 1856) switched over to warmer phase towards the end of the Talcher times as evidenced by stromatolitic limestone and marl (Pandya, 1987). Thus the Gondwana sedimentation was initiated in a post-glacial warm climatic condition. By the Kamthi period, ferruginous red beds indicated almost a sub arid climate and the sandstone thereafter might be interpreted as the indicators of a warm and humid time, facilitating diverse flora without extensive coal measures.

Sedimentation environment during the Talchers indicates lacustrine deposition in rift controlled lakes (Pandya, 1990); adorned with a north to north-westerly palaeo-current pattern, indicating Eastern Ghat granulites as the immediate provenance (Das, 1994). Rejuvenation of boundary faults in the Damuda period changed the basin configuration with braided and meandering streams flowing due NW and deposition in this fluvial regime under tropical warm humid climate resulted in the coal formation. Eventual filling up of receptacles, sub-basin making and arid deposits of the Kamthis confirm the shallowing of the basins.

The drought in the basins, enhanced through vertical oscillations, may have reversed the trend in Odisha sector of the Gondwanas, till the Lower Cretaceous. The vertical oscillations could have resulted in the yet another deepening of the basins with south-easterly palaeo-drainage this time. Another warm and humid tropical phase of climate with braided streams with moderate to high ground slope led to the massive deposition of the Athgarh Basin (Adyalkar, 1965 : Kumar and Bhandari, 1973; Mishra and Pandya, 1991). The sedimentation tactonics of the outliers in Phulbani-Bolangir-Athmallik, however, have a different story to tell perhaps of isolated intermontane basins in Permo-Carboniferous having their own independent sedimentation history.

The state forms a part of the stable landmass of the Indian peninsula and is largely composed of some of the oldest rocks of the earth's crust. This stable landmass has not been folded since late pre-cambrian time. It resisted all later mountain-building forces by differential block movements of uplift and subsidences; moreover, it has been exposed to the continuous action of denuding agencies over very long periods of geological time. The topographic features of Odisha are thus a combined result of long continued erosion, peneplanation and uplifts. During and after uplifts, streams not only dissected and deepened their valleys on the plateau surface but also in the up-raised rim-like edges. Physiographically, Odisha is, therefore, a heterogenous land made up of (1) a sea-board containing the deltaic alluvium of the Mahanadi, Brahmani and other rivers, also littoral deposits and parallel ridges of wind blown sand; (2) a hilly sub-montane region and (3) a rugged hinterland, diversified by a succession of plateaux, uplands, hills and valleys.

●

THALLPATHY7

3

RELIEF AND PHYSICAL DIVISIONS

- **Northern Plateau**
- **Eastern Ghat Zone**
- **Central Table Land**
- **Coastal Region**

Relief refers to the topography determined by mountains, hills, hill slopes, rivers, watersheds, river basins, valleys and plains. Odisha is a state of mountains, hills, hillocks, rivers and rivulets. The north and north-eastern portion is an extension of Chhota Nagpur plateau which lies to the West of Bengal basin and of which the Ranchi Plateau is the best example. This plateau is dissected along its borders giving rise to steep escarpments. The South Koel and the Subarnarekha rives drain this plateau in Odisha. Broadly, the districts of Mayurbhanj, Keonjhar and Sundargarh and some parts of Angul and Dhenkanal come in this plateau. The Plateau has gentle rolling forms with undissected flat lands cut by steep sided valleys (see Northern Plateau).

The southern parts of the state are the extension of the Eastern ghat mountains. The ghats run into fragmentary spurs and ranges down the east side of the peninsula receding inland and leaving board plains between their base and the coast. The range is cut into several discontinuous blocks of hills by many small rivers and rivulets. In the east flows the great Mahanadi river. Towards the north of the Mahanadi river there are several peaks above 1000 m in height (Meghasani, 1165 m; Thakurani, 785 m; Gandhamardan, 1060 m; Malyagiri (Malaya giri) 1187 m and Pallahara hills (980-1100 m). In the south west of Mahanadi the ranges run parallel the coast and the coast at some places is about 30-45 km away from the base of these ranges. These ranges were formed during early Cambrian and uplifted in late Cambrian period. The highest peak in these ranges is the Mahendragiri (1500 m). These ranges form the watershed between the west flowing rivers - (Machhkund, Sabari, Sileru, Poteru, Bhaskel and Indravati to name) and the east flowing rivers—Vansadhara, Nagabali and Rusikulya. The Sabri hills are a group of detached ranges. One gets a good idea of the peaks, hills, valleys when he moves covering Berhampur, Parlakhemundi, Gunupur, Rayagada, Phulbani hills, Salur, Sunki, Patangi hills, Koraput, Jeypore, Malkangiri, Machhkund, Sileru, Poteru, Kalimela, Balimela areas in Odisha and Vizianagaram, Visakhapatna and East Godavari areas of Andhra Pradesh.

In between the Chhota Nagpur Plateau and its extension in north and north-east and the easternghats in the south and south-west lies a vast stretch of table land called the central table land. This table land has also small hills and hillocks. Broadly the districts of Sambalpur, Bolangir and Dhenkanal including Angul constitute this table land. This covers the major portions of the Mahanadi and Brahmani basins.

The state, generally, slopes from north and north-east to the west and south-west and from south and south-west to east and then to the coast the coastal plains. From these physiographic points of view, the state is divided into four physiographic zones viz. : (A) the Northern plateau, (b) the Easternghat zone, (C) Central table land, and (D) Coastal zone.

(A) NORTHERN PLATEAU

This plateau, as stated earlier, is an extension of the Chhota Nagpur plateau, the southern extension of the central hill belt of India. It includes the districts of Mayurbhanj, Keonjhar (except Anandpur plains), Talcher, Pallahara of Angul district, Bonai, Tensa hills, Gangpur, Sundargarh and Panposh of Sundargarh district, and Bamara, Kuchinda and Redhakhol of Sambalpur district. At the eastern parts are the Similipal hill ranges of Mayurbhanj district including Bangirposi and Bisoi. This plateau is interspersed with small fertile valleys. The Cheliakot range rises to heights about 990-1100 m. The western portion is a table land. The entire plateau is dotted with small hills here and there including Joda, Badbil, Banspani hills. The southern part forms the watershed of Brahmani and Baitarani rivers. The Simulia hills have two peaks one at Similipal (1173 m) and the other at Meghasana (1160 m). The Mankadanacha (1100 m), Malaygiri (1190 m) in Pallahara and Gandhamardan (1002 m) of Keonjhar form the Baitarani-Brahmani interfluve. This region is a polycyclic region. These mountains are almost flat topped and run from North to South in the northern portion and NN to SSE in the southern portion (750-1100 m) above mean sea level. Bangirposi-Bisoi-Rairangpur zone provides a good view of the spread. (The mountains that separate the Tel, a tributary of the Mahanadi, from the Rusikulya basin have heights varying from 610 m to 1220 m). This plateau has rich resources of iron ores, coal and lime stone. The plateau is studded with quite many small hills here and there. Joda-Badbil-Kuliposh-Panposh-Gandhamardan-Banspal-Talkoi-Kanjipani-complex gives a good view of the zone. The hills in Sundargarh district decrease in height from Keonjhar boarder to Rajgangpur through Bonai, Gurudia, Koida, Sundargarh and Bargan. This is the region of "Great reservoir of mineral resources".

The important hills in this range are : Mankadanacha (1117 m) and Badampahar (1074 m) near Keonjhar boarder; Kumaritara (1065 m), Bichakhani (903 m) and Khandadhar (914 m) near Bonai; Rengalbera (664 m), Baghbindia (808 m), Raipiri (799 m) near Gurudia; Balia (1009 m) and Karaspani (757 m) near Koida; Man (590 m), Satpurlia (404 m) Jagijogan (448 m) near Sundargarh; and Mahabir (567 m) and Didra (765 m) near Rajgangpur. Panposh area has almost no hills.

(B) EASTERN GHAT ZONE

This zone may be considered to comprise of the old districts of Koraput (now Koraput, Rayagada, Nabarangapur and Malkangiri), Phulbani (now Phulbani and Baudh) and Kalahandi (now Kalahandi and Nuapara) of the state, This zone is the most mountainous zone. For convenience this zone can be divided into four sections, i.e., (i) North-East section, (ii) Central section, (iii) South-East section, and (iv) South-West section.

(i) The Northern-Eastern Section : The hills of this section in the Easternghat zone extend up to Nilagiri of Balasore district through Daspalla of Nayagarh and Kapilas hills of Dhenkanal district. This section is a low height hill section having plains and valleys on either side. This section gets loftier up to the peaks of Singaraja (860 m) and Mahendragiri (1575 m) and Delsagiri (1382 m) of Gajapati district. There are steep hill slopes and small valleys in between.

(ii) Central Section : This section represents the hills of Phulbani and part of north-eastern portion of former Koraput district. From Baudh the ghat hills are of 600-700 m height and continue up to Phulbani; in the west of Daringabadi of Phulbani district the height again increases to about 1200-1260 m (most of the hills are 900-1100 m). Again the height of hills decreases towards Kotagarh (340-500 m) and rises to about 1000-1100 m near Baliguda and decreases from Tumudibandh up to Madanpur-Rampur of Kalahandi district; Madanpur-Rampur area is almost a plain area. From Bhawanipatna towards Komna and Nuapara the height increases (varies from 300-800 m). From Kalinga through Ghumsar Udaygiri (G. Udayagiri) via Firingia-Phulbani, the section is a low height section and is studded with small height hills. The height of hills again rises from Khajuripada to Ranipathar and Puruna Cuttack and gradually falls reaching the plain areas of Baudh and Manmunda (only 150-300-600 m height). The Baudh-Manmunda section is fertile and is intensively cultivated.

(iii) The South-East Section : This section comprises of the Gunupur-Rayagada-Bisamcuttack-Kashipur-Chandrapur section. This is plateau of heights above 350 m. There are hills up to 750 m high. This section has given rise to narrow basin between Banshadhara and Nagabali rivers. In betwen Banshadhara and Nagabali a hill range upto 1100 m high stands. The two valleys run almost parallel. There are ranges of high and rugged hills on either side of the valley. The Banshadhara valley slopes down from a height of 1300' (390 m) near Ambadola to 260' (90 m) at Gunupur. The Nagavali side has higher hills. The valley of Nagavali falls from heights of 1200' (360 m) north of Kalyansinghpur to 500' (170 m) in the south of Rayagada. The Niamgiri hills in Gunupur Sub-division rise from 1000' to 4970' (330 m to 1492 m). The Kashipur area continues with the west and south-west of Rayagada up to Laxmipur is a wild country, a triangle of hills and valleys with a few patches of cultivable land. The Kashipur area from its western side slopes to the west and is drained by Golagada, a tributary of the river Indravati, while the south of Rayagada Tahasil is drained by Jhanjavati and her tributaries. This section receives less rainfall than other sections.

In south-west and west of Rayagada-Narayanpatna and Kashipur hills are all > 3000' high (> 914 m) and form a plateau. Among these the highest is Atma Dangar (4608', 1383 m), 8-9 km away from south of Narayanpatna. At the north-east of this village stands the highest point (4414', 1324 m). The Kailashkota hills lie between the valleys of Nagavali and Vansadhara.

Here there are summits of 914 m or more-Maltidangar (3304', 992 m), Jora dangar (3289', 987 m). On the left bank of the Banshadhara, east and north-east of Gunupur, rise the Puttasing hills (above of Langia Saura). Highest peak of these hills is the Thaladi dangar (3217', 965 m). From the north to south are the hills-Panchabati Mali (4835', 1450 m), Karnapadi dangar (5486', 1647 m), Meyamali Parbata (4921', 1476 m), Turia Dangar (5244', 1573 m), Deomali hills (5486', 1647 m), Polamakhan Parbat (5201', 1560 m), and Sirimanda Parbat or Dumuka (4642', 1393 m) Parbat.

The village Pattangi lies at the goot of Sirimanda Parbata (Dumuka Parbat). Deomali is also known as Dudhari. It has two very high and conspicuous peaks. Deomali is the highest peak in the district and in the state.

The hills of Koraput district (now Koraput, Nabarangpur, Rayagada and Malkangiri) are now gradually getting bald and suffering seriously from shifting cultivation (Podu, Jhuming) and soil erosion. The Government of Odisha have maximum concentration of soil conservation work in the easternghat zone.

(iv) South-West Section : The section broadly comprises the zone-South and South-West of Nagabali river with Koraput, Pattangi, Nandapur, Similiguda, Machhkund, Malkangiri, Padua, Balimela, Chitrakunda gradually falling in height upto Motu, the south-west most point of the state. To the south-west of Koraput is the Jeypore plateau. In the south-west section there are very high hills and these can be divided into four sub-sections having mean elevation of (3000', 1000 m), (2000', 700 m), (1000', 330 m) and (500', 160 m).

(a) Pottangi Plateau : This is a high elevation plateau. The line of high hills divides the state from the Visakhapatnam district of Andhra Pradesh. The lines of high hills with valley run from Salur, Sunki and Pottangi ghats and reduce in height gradually to Koraput-Jeypore through Damanjodi and Semiliguda. The high elevation research centre of the O.U.A.T. is situated at Pottangi (1120 m). While approaching Pottangi (Odisha) from Salur (Andhra Pradesh) side through the ghats via Sunki (Odisha), one gets a beautiful view of high hills and narrow and steep valleys. The valley towards Andhra Pradesh is large and flat. On the other side lie the small and narrow valleys of Odisha.

(b) The Nabarangpur - Jeypore Plateau : This sub-section has less-height-hills (about 700 m). In this section three rivers-Indrawati, the Kolab and Machhkund with their tributaries first flow towards the west and then southward into the Godavari basin of Andhra Pradesh. At the south-west are the Machhkund hills which fall rapidly and have the Duduma waterfall where electricity is being produced. The Nabarangpur-Jeypore section is almost plain. At and around Jeypore there are large number of small hills, some of these rise to 780 m. At other places the plain is broken by small hills among which those near Padagada (915 m), Boriguma (902 m) and Boipariguda (9120 m) need mention. The Nabarangpur plateau extends up to Bastar in the West and Raipur in the north CHHATISGARH. It has steep ghats at the south merging into Malkangiri (700 m) high hill section. Towards Jeypore it has low hills. In this area rainfall is less. In summer Nabarangpur and Umarkot areas become hot and dry.

(c) The Malkangiri Sub-section : This is the extreme south-west section of the state. In this sub-section the small hills hedge the valley of the Machhkund throughout its course; these are about 333 m above the river bed. The highest point in this sub-division is at the N.E. corner nearing Duduma fall at a height of about (3625', 1988 m) at Machhkund. At the eastern boundary the hills rise upto 1000-1100 m. This valley has plain area declining from elevations of about 270 m in the north around Govindpalli to about 130 m in the extreme south. Beyond this, towards the west and south west, lies the Dandakaranya area (around Kalimela). In this area the highest peak is Golikunda (1090 m) that runs for about 10 km upto Duduma fall via Balimela, Kalimela, Chitrakunda up to Motu, the southern most tip of the state where the boundaries of the states–Odisha, Andhra Pradesh and Madhya Pradesh meet. This plateau sub-section has more of the plain lands and less small hills here and there. At the east of Nandapur there are a series of hills, many peaks over (1280 m). Deomali and Kondiamali Parbat (1330 m) are the highest. About 16 km (10 miles) east of Padwa rises a mass of hills and from there the Kolab river originates; the chief among these are the Sankaram gutta (1595 m). It is on the boundary between Odisha and Andhra Pradesh and beyond this there are Chintapalli hills of Andhra Pradesh. At the north of Kolab there are small hills, only a few of these are above 1200 m.

The hill tracts of Kalahandi district chiefly comprise the ranges of hills which run from the north-east to the south-west of Bhawanipatna and western side of Nuapara. (The principal hill ranges belong to the Easternghats). The range merges with the Rayagada section (intercepted by the valley of Nagavali and Vansadhara). The easternghats extend to Nuapara while the other part is an extension of Chhota Nagpur plateau. The main peaks in this range are Tongri dangar (1229 m), Kattighara (953 m) and Karlapat (1213 m). The largest of these ranges is the Katpar-Puruvadi range. The Gaurgarh or the Sunabeda plateau only forms a part of this section. The elevation of this range is 931 m in the south, the central portion is called Birbhuri. At the west of the plateau the Deo-Dangri is about 929 m. high and at Darpani the height is about 887 m. The highest peak Tangri Dangar (1229 m) is in the Thuamul Rampur areas. Kunkot Parbat (852 m) in Kegan, Jamharpat Dongri (537 m), Burharas Parbat (741 m), Chochki Dongar (55 m) and Area Dongar (376 m), are important in Nuapara areas. Around Komna areas the important peaks are Supkon Dongar (882 m), Chaura Dongar (933 m), Godma Dongar (784 m), Guru Dongar (734 m) and Gaijhar Pahar (494 m). Around Khariar the important peaks are Barepat Dongar (1006 m), and Kachhi Dongar (506 m). Besides these, there are many unnamed peaks of considerable height. The western part of the Nuapara sub-division abounds in fine natural scenery and the wild precipitous ranges are visible for many km. distance.

The important valleys and plateaus in between these ranges are Nuapara plateau, Sunabeda plateau and Gauragarh plateau (610-915 m above mean sea level). Udanti and Sundar rivers have their sources from this plateau, the Udanti and Sundar valley, Tel valley and Utei valley are the other important valleys in this area.

(C) CENTRAL TABLE LAND

Mainly three districts—Sambalpur (now Sambalpur, Deogarh, Jharsuguda and Bargarh districts), Dhenkanal (now Dhenkanal and Angul districts), and Bolangir (now Sonepur and Bolangir districts) comprise this division.

Sambalpur and Bargarh including Padampur form an undulating upland varying in elevations from 146 m to 229 m above mean sea level excluding hills and table lands. The general slope is from north to south. The slope is broken by the rugged hills. There are isolated hills rising abruptly from the plains. There are also small hill ranges. The Bargarh portion is almost plain. Sambalpur does not contain large plains like Bargarh. Rairakhol, Deogarh and Kuchinda have less rich and fertile plains than Bargarh and Sambalpur. Rairakhol (Rampur, Redhakhol), Deogarh and Kuchinda contain valleys and plateaus unevenly distributed, cut off by small hills here and there. There are a series of low hill ranges in Redhakhol extending towards Mahanadi valley. Deogarh, Barkot, Kuchinda, Kirimira, Laikera, up to Pradhanpat form the hilly and forest clad section, interspersed are the valleys and plains.

The Bara Pahadas (12 hills) are the main hill ranges in the Bargarh district. These hills have heights upto 692 m at the peak of Debrigarh which has level ground and water supply at the top. At the north-west of Bargarh it separates Ambabhona and Laxmanpur from the rest of Sambalpur. The Bara Pahadas continue as a long chain to the east of Mahanadi and then decreases in height till these enter into Sundargarh district.

The Gandhamardan range runs along the southern boundary of Bodasambar, separating it from Sonepur. These hills have heights from 2000' to 3000' (630-915 m) and have the highest peak at Nrusinghanath (986 m), between Sonepur district and Bargarh district. Another range branches off to the west of Nrusinghanath in the N.S. direction and then in N.E. direction to meet Jagadalpur of Madhya Pradesh. Here it is broken by Ong river. Another range runs eastward to Tel and then to N.E. entering into Raipur.

Another range is the Jharghanti range that runs towards Rengali, north of Sambalpur. Its highest point is 516 m above the plain. There are a series of broken ranges in the south of Sambalpur running parallel to the Mahanadi attaining 476 m height at Mundher and 710 m at Budhenpalli. At Dhama, on the bank of Mahanadi, height is about 450 m. There are other small and scattered ranges. The Sunari hills (near Sunari village, S.W. of Sambalpur) have height about 472 m above mean sea level. Gotwaki and Guja are two medium height hills (350-380 m). The Maula Bhanja (430 m) in the west of Rengali needs mention too. It forms the Katarbaga range near the village Katarbaga. The tops of these ranges are not flat.

In the Deogarh tract there are Khajuria range (upto 745 m), Pradhanpat range (743 m) and Kaidanta range (816 m), towards north and north-west of Deogarh near Khajuria; there is a vast plateau in between from west-east to the bank of river Brahmani near Batispara. The Powdi (Pawri) range (678 m) runs in the eastern side of the river Brahmani. It is the abode of the Powdi Bhuyans around Barkot. The Ushakothi range near Kansar and Reamala extends upto Kuchinda and Jamankira towards the east. These have heights from 600 to 720 m and are thickly forest clad.

There are two small hill ranges in Kuchinda. One runs from Bandhabar Pragana and runs up to Bonai of Sundargarh district and meets Khajuria and Pravasuni forest areas. The second is the Usakothi and Bodarma range extending from Gaurpalli to *Kandh* area of Deogarh. There are many hills around Redhakhol forming continuous ranges in the west, east and north. In the north it extends up to Baudh boarder and Kisinda valley; the central section runs from Sambalpur to Athamallik and Anugul. Paria (759 m), Chomal (723 m), Buria Pahar (693 m), Khajuridhia (625 m) and towards the north Pali (565 m), Derajodi (552 m), Surusuri (577 m) Bhaleswar (598 m), and Bhaladary (564 m) are a few to be mentioned. There are extensive plain lands to the south of Redhakhol.

The river Brahmani bisects the Dhenkanal district in a semi circular manner with the hilly tracts to its south and north. The loftiest hill in the district is Malayagiri (Malyagiri) near Pallahara. The high hills to the north extend up to Banai and Keonjhar. There are also a few high peaks near Pallahara boardering to Keonjhar. These peaks rise to heights of 762 m (2500'). Besides, there are few peaks in Kamakhyanagar sub-division. These are Baruan (387 m), Bari Phuljhari (542 m), Sundarkhol Pahar (489 m), Udaigiri (437 m), Ranjagarh Parbat (452 m), and a few unnamed peaks less than 500 m. Another known peak is Kapilash (637 m) towards N.E. of Dhenkanal. Other hills are Gumaria (586 m) and Saptasajya hills in the south and Dalar Parbat (440 m) towards north. There are quite a few small hills dotting between Dhenkanal and Athagarh. The hills reach peaks of about 610 m in height. Mandaria (621 m), Bankamundi (636 m) are in the west and east of Hindol respectively. There are a few peaks around Angul. These are about 610 m in height. Many of them have no specific names. Among these Banamundali is the highest (790 m). There are Panchadhar and Hingmandal hills near Athamallik; Panchadhar has peaks at (915 m, 3000') while the peaks of Hingamandal rises to 896 m height. In between two hills ranges there are fertile valleys. Several mountain springs originate from small and medium mountains.

The southern hilly region forms the watershed between Mahanadi and Brahmani rivers nearing Athamallik and Angul. This region runs parallel to Mahanadi and is wider at its west. Towards the east it becomes narrower. The valleys of *Ghosarajora* and *Sindhorajora* are separated by a mountainous high land dotted with several peaks, none exceeding 610 m in height, and are flanked to its south by Hingmandal hill with the highest peak at 906 m. Towards the west lie the mountains of smaller heights. The Panchadhar hill lies to the south-east of Hingmandal hill. The Mahanadi valley nearing this is wide in its middle and comes to an abrupt end where the Mahanadi is obstructed by *Chandaparbat* and *Sanakania* mountain. Here the river changes its course from S.E. to East. After this, from the village Sitalapani the river passes in between solid rocks up to the village Barmul and this narrow gorge is called Satakosia ganda (1 kosa = 2 miles; the 14 mile ganda (gorge). The district is studded with small to medium height hills.

The Gandhamardan and its extension are important hills in this zone forming natural boundary to the north-western side of the Bolangir district. This range consists of several hills, the highest among them being Gandhamardan (1004 m). The smaller hills like Butel (814 m), Chahdli (802 m), Thuta (627 m), Bender (585 m), Patpani and Chhtardandi need to be mentioned. At the top there is laterite cap. Rain water soaks through the laterite, collects down and oozes in springs on both sides. From the northern crest springs-Kapil-dhara, Bhimdhara and Chal-dhara; descends to the foot of the hill and comes to the plains of Nrusinghanath (Bargarh district). On the southern slope a similar stream issues from the crest of the range and is known as Harisankar. The crest of this range of hills is the 10 mile (16 km) long Gandhamardan plateau standing at an average height of 914 m. This Gandhamardan hill, the famous hill described in the Ramayana was known as Gandhagiri or Parimalagiri.

Quite close to Bolangir town towards the N.W. is the hilly belt extending up to Mahadasani of Bodasambar in Bargarh district; towards the S-E it extends up to Sikarpat, in the Kandhan tract of Gudvella. Bhimdunguri, Matki (790 m), Bonda and Khansel are small hills in this zone. The Singhasan hill system is separated from this range by an extensive plain and river Mahanadi. The Singhasan hill system extends from north to south and attains height of 2045' (623 m), at some points. Gandhamardan and Singhasan are continuous ranges while others are discontinuous.

(D) COASTAL REGION

The undivided districts of Balasore (now Balasore and Bhadrak), Cuttack (now Jajpur, Kendrapara, Jagatsinghpur and Cuttack), Puri (now Puri, Khurda and Nayagarh) and Ganjam (now Gajapati and Ganjam) comprise this coastal zone. The new districts like Balasore, Bhadrak, Jajpur, Kendrapara, Jagatsinghpur, Puri, Khurda, Ganjam and Gajapati touch the Bay of Bengal. These have been formed by the alluvial deposits of the rivers like Subarnarekha, Budhabalanga, Baitarani, Brahmani, Mahanadi and her branches and sub-branches, Rusikulya, Banshadhara and Nagavali. The coastal region from the sea extends inland ward for about 100-120 km. It has its saline, belt, low lying gahir and pat land and the gradually rising uplands merging with northern plateau at the north (Mayurbhanj and Keonjhar), Central Table land (Dhenkanal in the middle) and Eastern ghat ranges in the south. This coastal zone can be broadly divided into three long and narrow strips from N.E. to S.W. the first strip being the saline coast line with mangrove (Rhizophora) vegetation, the second strip the alluvial plain (the old Mughalbandi areas) and the third strip the hilly strip (Dalijoda areas). In the first strip there are no hills. In the 2nd and third strips there are small hills. There are three lakes–Anshupa (near Athagarh), Sara (in Puri district) and Chilika (in Khurda district).

The 'Sara' lake is a back water lagoon of river Bhargavi. It is about 7 km long and 3.5 km. wide. It has no outlets to the sea and it is separated from the sea by wide and high sand ridges.The 'Chilika' lake is the biggest lake in India. In summer it covers an area about 900 sq. km and in rainy season swells to cover about 1200 sq. km. Its mouth to the Bay of Bengal is narrow. On the sides of this narrow mouth there exists and ridges.

THALLPATHY7

4

RIVER SYSTEM

- **Rivers from Chhotanagpur Plateau**
- **Rivers from Amarkantak Plateau**
- **Rivers from Keonjhar Plateau**
- **Rivers Originating from the Eastern Slopes of the Eastern Ghats**
- **Rivers of Southern and South-Western parts of Odisha**

All the rivers of Odisha are primarily peninsular rivers and have taken their origin from three important sources. They are the Chhota Nagpur plateau in the north in Bihar, the Amarkantak plateau in west in Madhya Pradesh and the Eastern Ghats within Odisha. All these rivers are non-perenial in character as none of them are snow-fed like Ganga or Brahmaputra. Most of the major rivers of Odisha have their source beyond the borders of Odisha. The rivers which have taken their origin within Odisha are either minor rivers of local importance or they are the tributaries of second, third or even fourth order streams to the major first order rivers which have their origin beyond Odisha. All the first order rivers have drained to the Bay of Bengal. As per their sources, a brief classification of the rivers of Odisha is given below :

(A) THE RIVERS FROM CHHOTA NAGPUR PLATEAU

There are two such rivers in Odisha which have originated from Chhota Nagpur plateau. (Nagri Village) -(Ranchi dist) of Jharkhand

1. THE SUBARNAREKHA : (3 States) - odisha, WB, Jharkhand

The Subarnarekha in the north-east, have originated from the southern slopes of the Chhota Nagpur plateau in Bihar and flow for a considerable distance in the West Bengal and for a very short stretch it forms the boundary between Odisha and West Bengal. Then it re-enters Odisha at Lakshmannath slightly to the north east of Jaleswar and drains into the Bay of Bengal. It has an estuarine mouth because of the daily tides. Its very name suggests that in the Chhota Nagpur plateau it is flowing through gold bearing rock structures of very minor content. This river is a very little use to Odisha as excepts its lower reaches, it is not flowing within the State. It only brings disastrous floods to its lower reaches and Jaleswar, Bhograi as well as Baliapal police-stations are mostly affected in Balasore district. The recent agreement among the Governments of Odisha, West Bengal and Bihar to harness it for irrigation and hydel power generation will go a long procedural way to solve the age-old problem of flood in lower reaches of Odisha.

(433 km) → 70 km Odisha

2. THE BRAHMANI :

Sankh - Mandire Dam

The Brahmani also takes its origin from the southern slopes of the Chhota Nagpur plateau in Bihar and enters Odisha in the Sundargarh district. It has got two major tributaries, the Sankh and the Koel. Both these tributaries have met at Vedavyas near Rourkela and from the main trunk stream of the Brahmani further down.

It is having north-south course from Rourkela to Talcher and has formed a gorge at Rengali, south of Barkot, where its water is being harnessed for irrigation and hydel power. In the Sankh; the Mandira Dam is detention reservoir, meant for supply water to the Rourkela Steel Plant and the Steel Township. These are the two most important projects in the upper and the middle reaches of the Brahmani river. From Talcher down stream the river has changed its north-south course and has started flowing from North-North-West to South-South-East till Hindol road. Then it has taken a North-East-East course till Bhuban from where it has started to flow in almost east-west direction to meet the Bay of Bengal at Wheeler Island and Dhamra. The Brahmani has a total length of 701 km. Its delta starts from Jenapur in Cuttack district where it has been split into major streams, the Brahmani and its distributary Kharsuan. The Kharsuan is also known as 'River of Sorrow' due to flood havoc to a large area upto Kanika Ring Embankment, in Aul Block. From the apex of the delta to the mouth its length is 149 km. Its right bank distributary meets the Birupa, a left bank distributary of the Mahanadi at Indupur. Thus to this extent the Mahanadi and the Brahmani have a common outlet for their flood water through Maipura and Chhattisgarh, then the Wheeler Islands. Since the Brahmani has taken its source from Bihar and Jharkhand it is an interstate river.

(B) RIVERS FROM THE AMARKANTAK PLATEAU

1. THE MAHANADI :

The Mahanadi is the river which has taken its source from the Amarkantak Plateau. It flows through Madhya Pradesh and enters into Odisha near Padigan. It has taken a course mostly north-west-north to south-east-south direction in Madhya Pradesh. In this part it is draining the Chhattisgarh plains and has made it very fertile to be termed as the 'RICE BOWL' of Madhya Pradesh and Chhattisgarh. At Hirakud in the district of Sambalpur, the longest dam in the country has been built over the Mahanadi and an artificial lake has been built which stretches upstream for about 52.8 km. from Hirakud. Its net irrigated area is 35,486 hectares and ultimate installed capacity is 4,75,000 KW. of hydel power. From Sambalpur down stream up to Sonepur the course of the Mahanadi is almost north-south and in this section a number of tributaries have met with the Mahanadi on its right bank. The most important among them are the Jira and the Jhaun which are draining the Bargarh Plains. At Sonepur, the Tel largest tributary of the Mahanadi, is draining to the Mahanadi on its right bank. From here up to Boud, the Mahanadi has a perfect east-west course while from Boud till Banki, it has a north-west-north to south-east-south course. In this portion the Mahanadi has crossed right through the Eastern Ghats and has formed a gorge at SATKOSIA where it has cut through the rock strata of the Eastern Ghats.

It has entered the plain stage at Naraj in Cuttack district where initially it met the old shore-line of the Bay of Bengal before the formation of delta.From this point the bifurcation of the main trunk stream starts and the delta stage begins. At Naraj many river Islands have been formed and the first bifurcation gave birth to the river Kathajodi from the Mahanadi at Cuttack, the Birupa took off from its left bank. At this stage anicut have been constructed at Jobra over the Mahanadi and another over the Birupa. The delta irrigation canals have started from these anicuts. It has a total length of 852.8 km. from its source to the delta head and 107 km. from its upper of the delta to the delta mouth. Further down stream, the Mahanadi is bifurcated into a number of distributaries and the Kathajodi is bifurcated into Kuakhai. Further down stream the Kuakhai has been divided into Daya and Bhargavi. The Daya and the Bhargavi are draining into the lake Chilika while all others are draining into the Bay of Bengal.

There are seven rivers originating from the Mahanadi Delta. These rivers are primarily drainage channels of short length which have originated in the Mahanadi delta from the low interfluves of the distributaries of the Mahanadi. These are slow and sluggish in nature as the slope value between their source and the mouth is very negligible. These are Samolia, Gobari, Prachi, Kadua, Dhanua, Ratnachira and Nuna.

The Samolia originates from the village Haripur and flows straight to Bay of Bengal in a easterly course. Its bed is silted up and it fails to carry the flood waters effectively. The Gobari has originated from Devidola and has joined the Devi river near Bandasahi. The Prachi originally branched off from the Kuakhai but its head has been silted up and hence closed. Now it flows from the Phulnakhara and drains the area between the Kandal and the Kushavadra river. The Kadua river drains the interfluve between the Prachi and the Kushabhadra. The Dhanua, another small river, originates near Balipatna and after flowing for about 25 km. It drains to the Kushabhadra. The Ratnachira takes its origin near Mukundapur village and flows in a south-west direction. It drains to the Bhargavi. The Nuna rises near Ghoradiha hills and drains to the Daya near Sahupara.

From the past experience, it can be easily be assumed that in the years of minimum floods, water hyacinths develop in the marshy areas of the usually flooded regions of the lower reaches of the Mahanadi delta.

(C)RIVERS ORIGINATING FROM KEONJHAR PLATEAU

1. THE BAITARANI :

The Baitarani is the only such river originating from the Keonjhar Plateau. It has taken its sources from the Guptaganga Pahar of Janghira-Dhenkikote region having an average elevation of about 600 m. and a maximum elevation of 668 m. It has a number of minor tributaries which have originated at various elevations from a region bounded by Janghira in the north-west, Dhenkikote in the north-east, Ghatagan in the south-east and nandona in the south-west. It has a total length of 344 km. The principal tributaries of the Baitarani are Deo, and Indrani. It is flowing by the side of Anandapur, a sub-divisional head-quarters of Keonjhar district. Another peculiarity of the Baitarani is that in its lower reaches it is draining to the distributaries of the

Brahmani, south of Chandbali, and is having a common mouth to the Bay of Bengal, at Dhamra. Another important town located by its side is Jajpur town. The Baitarani has an average slope of 2.6 m per km. of valley long profile. Thus its erosive capacity is quite high due to high slope values and high rainfall (above 150 mm.) in the Keonjhar Plateau.

(D) RIVERS ORIGINATING FROM THE EASTERN SLOPES OF THE EASTERN GHATS

There are a number of rivers which can be termed as local rivers with limited length and limited volume of water. These rivers are small in their valley long profile and have a much steeper gradient. This is mainly because these rivers reached their base level of erosion within a short length of flow as the Eastern Ghats have approached the sea on the coast of the Chilika lake. The most important among these rivers are the Budhabalanga, the Salandi and the Salia.

1. THE BUDHABALANGA :

The Budhabalanga in Mayurbhanj district has taken its origin from Similipal massif to the south of the Similipal Garh, which has an elevation of 1082 m. near Khajuri. This massif has maximum elevation of 1148 m. at the Meghasani and the Budhabalanga has drained to the Bay of Bengal off Balasore coast slightly to the north of Chandipur. It flows by the side of two district headquarters towns of Baripada and Balasore. It has a maximum length of 175 km. Thus the average slope per 1 km. is 6.5 m. Hence its erosive capacity is quite high because of higher slope values and in the Similipal massif the average rainfall exceeds 150 cm. Thus the Baripada Plateau is highly eroded.

2. THE SALANDI :

The river Salandi is a small hill stream which has originated from the southern slopes of the Similipal massif at Meghasani mountains which has an elevation of 1165 m. It is flowing by the side of Bhadrak district. This river is harnessed for irrigation purposes at HADAGARH and the project is called the Salandi Project. The Salandi after flowing for 140 km. is not directly draining to the Bay of Bengal through an independent mouth of its own but it is discharging its water to the Baitarani, a few kilometres upstream of Chandbali.

3. OTHER STREAMS :

There are number of small but rapid streams to the south of the Mahanadi delta and are draining to the lake Chilika. Amongst them the Salia is the most important. All these rivers are taking their origin from the eastern slopes of the Eastern Ghats. The average length of these streams is 30 km. and the average height of the Eastern Ghats in this part is 500 m. Thus the per kilometre gradient is 17 metres which is very high, compared to many other rivers of Odisha. Thus they are turbulent and also dry up soon after the rainy season. All these rivers are silting up the lake Chilika from its western shore.

4. THE RUSHIKULYA :

The Rushikulya has well developed catchment basin but has failed to develop a delta in its lower reaches due to strong off-shore long current at its mouth. The basin almost pearshaped with a well developed dendritic tributary system. The major tributaries are the Dhanai, the

Baghua. The Mahanadi is located on its left bank and the Patama and the Ghodahada on its right bank. The most important of them is the Mahanadi which has met the Rushikulya at Asika. Most of them have taken their sources from the common interfluves of the Tel, the Mahanadi and the Vamsadhara. This river has been harnessed from a very long time (1868) for irrigation and detention reservoirs constructed at Soroda and Bhanjanagar. The Plains of Ganjam are irrigated by a network of contour canals. The crest height of the Eastern Ghats at the source of Rushikulya is 1223 m. near Sikaketta. The water divide varies from 600 to 1200 m. in elevation. The maximum heights have been reached at Singaraju (1500 m), Mahendragiri (1500 m) and Devagiri (1360 m). These mountains form the main range of the Eastern Ghats. The drainage pattern is typical dendritic type. The Rushikulya is draining to the Bay of Bengal near Ganjam town.

(E) RIVERS OF SOUTHERN AND SOUTH-WESTERN PARTS OF **ODISHA**

1. THE BAHUDA :

The Bahuda is a small hill stream which has taken its source from the Singaraju Parbat near Andanda, having an elevation of about 1516 m. It is draining to the Bay of Bengal at Ichhapur marsh in Andhra Pradesh.

2. THE VAMSADHARA :

The Vamsadhara is draining the Gunupur plateau between Rayagarh and Paralakhemundi. It has taken its source to the West of Durgapanga which has an elevation of 763 m. It has a number of minor tributaries which have met the main trunk stream in its left bank and right banks. These are relatively unimportant as they are mostly hill streams and are of very little use to agriculture. It is draining to Bay of Bengal at Kalingapatnam in Andhra Pradesh. It has a total length of 230 km. of which only 150 km. is in Odisha.

3. THE NAGAVALI :

The Nagavali is also another inter-state river which has taken its source in Odisha and has flowed for a considerable distance in Andhra Pradesh before draining to the Bay of Bengal south of Srikakulam. It has taken its source south of Lanjigarh in Koraput district. The most important town by its side is Rayagarh. Through this valley the railway line linking Vizianagram with Raipur has crossed the Eastern Ghats. This river is not of great importance to Odisha so far as agriculture is concerned. It has a total length of 210 km. of which 100 km. are in Odisha and rest is in Andhra Pradesh.

4. THE GODAVARI SYSTEM :

The Godavari system consists of the tributaries of Godavari river. The main tributary is SILERU, which has met the Godavari on its left bank near Kunavaram. The SILERU and the SABARI who have met each other at Motu, the extreme south-west point of Odisha. Incidentally the Sileru forms the south-eastern border and the Sabari the south-western border of Odisha in Koraput district. The MACHHAKUND river, another name of Sileru river in its upper reaches, has been harnessed for generating hydel power. The Machhakund Hydro-Electric scheme is a joint project of the Governments of Odisha and Andhra Pradesh, with 114.75 MW installed capacity. Odisha gets 30% of its share amounting to 34 MW. The Balimela reservoir has been created to generate hydel power from the Sileru river. The Poteru river is a second order stream which has also been harnessed to irrigate the interfluve areas between the Sileru and the Sabari rivers, popularly known as the Malkangiri-Motu uplands. This area has been inhabited by the refugee from Bangladesh. All these rivers are flowing in a north-north-east (N-N-E) to south-south-west (S.S.W) direction and they are draining the Malkangiri district.

The INDRABATI, another tributary of the Godavari, is flowing in a east-west direction and is draining Nabarangpur uplands. This river is being harnessed to irrigate the dry uplands traditionally suffering from drought.

Artificial Reservoirs

Sl No. (1)	**Name of Reservoir** (2)	**Name of River/Nala** (3)	**Name of Basin** (4)
1.	Salia	...... Salia	Rushikulya basin
2.	Dhanei	...Dhanei	Ditto
3.	Maladia	...Tributary of Burhabalanga	
4.	Balidiha	...Palapala	Ditto
5.	Khadkai	...Khadkai	Subarnarekha basin
6.	Hadagarh	...Salandi	Baitarani basin
7.	Ramiala	...Ramiala	Brahmani basin
8.	Dadaraghati	...Bagachheranala	Ditto
9.	Mandira	...Sankh	Ditto
10.	Rengali	...Brahmani	Ditto
11.	Derjang	...Ditto	Ditto
12.	Gohira	...Gohira Nala	Ditto
13.	Aunli	...Aunli	Ditto
14.	Singda Jor	...Singda Jor	Ditto
15.	Kuanria	...Kuanria	Mahanadi basin
16.	Salki	...Salki	Ditto
17.	Hirakud	...Mahanadi	Mahanadi basin
18.	Ang Barrage	...Ang	Ditto
19.	Saraphgarh	...Tributary of Laha River	Ib sub-basin

Sl No. (1)	Name of Reservoir (2)	Name of River/Nala (3)	Name of Basin (4)
20.	Jharbandha	...Kokri Jhar	Ang basin
21.	Dumerbahal	...Tributary of Ang River	Mahanadi basin
22.	Saipala	...Ang	Mahanadi basin
23.	Sunder	...Sunder	Ditto
24.	Hiradharbati	...Rushikulya	Rushikulya basin
25.	Utei	...Utei	Mahanadi basin
26.	Ghodahada	...Ghodahada	Rushikulya basin
27.	Bahuda	...Bahuda	Ditto
28.	Baghua	...Baghua	Ditto
29.	Bhoskel	...Bhoskel	Indravati basin
30.	Dahuka	...Dahuka	Mahanadi basin
31.	Balimela	...Sileru	Poteru basin
32.	Poteru	...Poteru	Ditto
33.	Ramanadi	...Ramanadi	Rushikulya basin
34.	Daha	...Daha and Kalinga (Tributary of Loharkandi River)	Ditto
35.	Upper Kolab	...Satiguda	Kolab basin

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THALLPATHY7

5

CLIMATE

- Factors influencing the climate
- The mechanism of monsoons and their origin
- Characteristics of monsoon
- Onset and progress of monsoon
- Nature and significance of monsoon rain
- Climatic Regions
- Agro-climatic Zones
- Parameters of development

FACTORS INFLUENCING THE CLIMATE

Climate indicates a generalised and composite picture of the average weather conditions spread over a long period, for a given large area. Due to the combined effects of the variations of the major climatic elements in different parts of the world and also the varied nature of the earth's surface, every location has a distinctive climate.

"The factors which influence the climate of a place are as follows :

(a) Latitude : Temperature, in general, decreases from the tropical to polar latitudes. Thus, Peninsular India, which lies mostly in tropical latitudes, experiences no winter season. On the other hand, the Northern Plain of India lying north of the Tropic of Cancer has a distinct winter season. Odisha lies within Tropic of Cancer.

(b) Nearness to the Sea : Places near the sea have more equable climate than those in the interior of the land. For this reason, the diurnal and annual variation of temperatures are greater in the north-western part of India than in the coastal plains. Odisha Coastal Plain stretch from the Subarnarekha in the north east to Rusikulya in the south-west.

(c) Altitude : Temperature normally decreases with increasing height. Thus, the mean June temperature of Delhi (215 m. above sea level) is 40.2°C and of Simla (2,170 m above sea level) 28°C.

(d) Direction of Prevailing Winds : In Peninsular India, the direction of prevailing summer monsoonal winds is from the west. Thus, places on the western margin of Peninsular

India experience more rainfall than those on the eastern margin. Likewise, the direction of south-west monsoon in the Ganga Plain is from the east. Thus, the rainfall decreases from the east to the west in this region.

(e) Direction of Mountain Ranges : When the moisture-ladden winds are confronted with the mountain ranges, they are forced to rise up and cause heavy rain in windward side while the rain is less in leeward side.

(f) Character of Soil : Different kinds of rocks or soils absorb heat at different rates. For this reason, sandy desert of Rajasthan has great daily and annual ranges of temperature, while the range of temperature is less in the deep alluvial soil of the lower Ganga basin.

THE MECHANISM OF MONSOONS AND THEIR ORIGIN

Monsoon are large scale seasonal wind systems blowing over vast areas of the globe, persistently in the same direction, only to be reversed with change of season. They affect the largest land masses. Asia is the only continent which experiences regular visit of monsoons of completely reversing and persistent wind regimes. Australia and Africa are also affected by monsoons though not to the same extent as south east Asia.

In northern winter due to extreme cold, a semipermanent intense high pressure develops over Siberia. From the periphery of the Siberian high, northerly to northeasterly winds blow across eastern Asia. This wind system extends into Bay of Bengal where it is reinforced by a similar stream from India. However, strong winds, often attaining gale force are quite common over the West Pacific and South China sea. In summer, the reverse occurs. The pressure over the interior is lower and huge mass of air including that from southern hemisphere is drawn into circulation. The south east trades of the south equatorial Indian ocean after crossing the equator, due to the action of Coriolis force, become southwesterly and invade the whole of South Asia. This constitutes the summer monsoon or SOUTH-WEST MONSOON over India. The winter monsoon is also known as the northeast monsoon. For similar reasons, northern portion of Australia and West Africa experience monsoons though their development is not as intense as that of Asiatic Summer monsoon.

Ramage (1971) analysing the question still further, prescribed the boundaries of the monsoons to an area enclosed 35° N and 25° S and between 30° W and 173° E. However, monsoons over southwest Africa falling within this area are poorly developed. India and adjoining seas are the only regions where the seasonal wind shifts together with their persistence are fully established year after year with unfailing regularity.

CHARACTERISTICS OF THE MONSOON

Thermal origin of monsoons as described above, is indeed, an over-simplification of the phenomena. Although the classical concept is not totally rejected considerable work on the genesis of monsoons, particularly the Indian southwest monsoon, is being undertaken by the world meteorological community. The summer monsoon is a major pertubation in the general circulation of the atmosphere. It serves as a large scale mechanism of redistribution of excess of heat, received in the equatorial areas to higher latitudes. It is, therefore, not surprising to find the interest, it generates among meteorologists spread all over the world. Concerted efforts on the data gathering and undertaking of intensive studies on monsoon by various meteorological services and organisations from different nations began only during the last two decades. These were and are still being undertaken with perfect international cooperation and coordination.

The first attempt was during International Indian Ocean Expeditation, (IIOE), from 1962 to 1965. This was followed by Indo-Soviet Monsoon Experiments in 1973 and 1977 with limited participation by other countries. The Monsoon Experiment, MONEX-1979, organised by jointly by Global Atmospheric Research Programme (GARP) of the International Council of Scientific Unions, (ICSU), and the WMO under the WWW programme is the largest scientific effort ever made to extend the frontiers of our knowledge of the monsoons by the international scientific community. Scientific results of these endeavours are too intricate and complex to be described here.

We shall be satisfied in understanding some of the important synoptic features of the Indian summer monsoon and see how various features of the monsoon can be predicted. Monsoons as reversing seasonal surface wind system over the north Indian ocean were discovered about six centuries ago by the early navigators of the sailing vessels. The word 'Monsoon' has its origin in the Arabic root 'Mausin' which means season. Little was known in those days about the atmospheric structure. In face with the onset of monsoon the whole atmosphere over the area, affected by monsoons, undergoes conspicuous and sudden changes. The moist south westerlies of the monsoon extend vertically upto 6 km. replacing the prevailing northeasterly winds of the pre-monsoon and north east monsoon seasons. In the surface layers the intratropical convergence zone (ITCZ), from its mean winter position close to the equator rapidly shifts about 20° to 25° N to establish itself as the monsoon through over the Indo-Gangetic Plains. Further, complete reversal in wind circulation at all the levels of troposphere takes place. This mean upper winds over India at 200 mb during April and July, April winds represent the conditions before the onset of the monsoon and that of July denote the full monsoon circulation. The contrasting change from westerly circulation to easterly wing regime is quite apparent. The westerly subtropical JET STREAM located to the north of about 20° N, with the onset phase of the monsoon, suddenly shifts to the north of Tibetan Plateau. The sudden shift may be considered as the forerunner of the advent of the monsoon over Sri Lanka and extreme Southern part of India. Simultaneously, the EASTERLY JET STREAM, characteristic of the southwest monsoon appears over the peninsular India. It, however, appears at a greater height than the westerly JET. The JET STREAMS occur in the vicinity of the tropopause which is the highest in the tropics and lowest in the polar regions. The subtropical JET occurring at lower altitudes is related to the atmosphere of the middle latitudes whereas the easterly JET entirely belongs to the tropical atmosphere. The northward shift of the westerly JET implies that the midlatitude systems are separated out and donot have direct bearing on the synoptic patterns of the active and strong monsoon. The presence or the influence of the midlatitude systems during the monsoon period over these areas only results in WEAK MONSOON conditions.

Upper air temperature distribution also reversed with the onset of monsoon. We find April and July mean isotherms at 300 mb level over India and neighbourhood. The isotherms are labelled in degrees Kelvin or in absolute units (The absolute unit is 273 degrees greater than the celcius unit). It may be seen that the seat of warm air in April has shifted from over the peninsular India and adjoining sea areas to north India and neighbouring countries. July temperature in the warm which is higher than that in April. This is again related to the height of the tropopause and characteristics of the tropical atmosphere. Thus, the monsoon brings about a total change in CIRCULATION as well as the PHYSICAL CHARACTERISTIC of the atmosphere. Unless otherwise specified, the word 'monsoon' will be understood as the INDIAN SUMMER MONSOON or the SOUTH WEST MONSOON.

Monsoons like many other words connotes both a technical and a popular meaning. For a meteorologist it is simply seasonal wind system and therefore he always prefixes it with SOUTHWEST or NORTHEAST. In his professional work he concentrates his studies on the characteristics of the wind systems. The rains they produce are simply the effects of the circulation patterns. But, for the common man, the administrator and the agriculturist in the field, monsoon implies rainy and its onset is a welcome feature to get rid of the gruelling heat of summer, to commence economic and other planning activities and to look forward for green fields in anticipation of good harvest. After all, the meteorologists has to realise that his professional advice is for the benefit of the society he is serving. So, naturally he has to set aside his scientific jargons and identify monsoonal rain as monsoon and apply himself to the challenging task of predicting rainfall, its distribution and intensity, both in space and time.

ONSET AND PROGRESS OF MONSOON

Since the onset is from the south and the withdrawal of monsoon is from the north the duration of the North India is shorter than that over the peninsular India. Over the extreme peninsular India, the withdrawal of the southwest monsoon often coincides with the establishment of the northeast monsoon. From circulation changes it is possible to distinguish them both. Generally by the end of October the change takes place. There were several occasions in the past when the monsoon arrived over certain parts of the country about a fortnight earlier or later than the normal dates of onset. Similarly, it had withdrawn either earlier or later.

The progress of monsoon also shows considerable variation. The southeast trades on crossing the equator get deflected and become south-westerlies. They divide into two branches by the time the flow reaches Sri Lanka and progress further northwards as the Arabian sea branch and the Bay of Bengal branch. Often it becomes difficult to distinguish initial monsoon rains from the then prevailing pre-monsoon thundershowers. This difficulty is more pronounced in Kerala and over northeast India. Incidentally, these are the areas where the Arabian sea branch and the Bay of Bengal branch respectively strike the country first.

Early or late onset of the monsoon does not provide any clue as to its total behaviour in terms of its rainfall. It also does not give any indication whether the monsoon will progress normally. But it is usually observed that the progress of monsoon is arrested after its initial northward movement by about 500 km. For further progress, a fresh surge is necessary. The

Bay of Bengal branch which arrives earlier over the Andaman sea that the appearance of the Arabian sea branch over the coast of Sri Lanka and India, gradually progresses northwards. The northward extension of the monsoon is arrested by the Himalayas. But it effectively penetrates as continuous south westerly flow across Burma, Thailand, etc.

Northeast Monsoon :

Two regions with scanty monsoon rain in India are Rajasthan and Tamilnadu. Over Rajasthan the monsoon air shows enough moisture but it lacks necessary mechanism of vertical lift. In fact, some studies have indicated the presence of large scale subsidence over Rajasthan during the monsoon. In the case of Tamilnadu, the story is different. With reference to monsoon the area lies on the leeward side of Western Ghats. The orographic lift on the windward side removes most of the moisture by precipitation. The rainy season for Tamilnadu and adjoining coastal Andhra Pradesh is the north-east monsoon. The spectacular change that takes place between the two monsoons is the CHANGE to of WIND DIRECTION from Southwest to Northeast over the Bay of Bengal, the Indian peninsula and the Arabian sea. The onset of northeast monsoon is a gradual process. It is often difficult to specify its period of arrival over Tamilnadu, which is the main beneficiary of its rainfall.

The polar orbiting satellite cloud data now available once or twice a day are not enough to follow the movement of cloud patterns or to assess its intensity. The frontiers of geographical knowledge is changing and progressing ahead with time.

TABLE – 3

Normal and actual rainfall in Odisha

Sl. No.	Year	Normal rainfall (in M.M.)	Actual rainfall (in M.M.)	Increase (+) or decrease (–) from Normal rainfall	
				(in M.M.)	(in Percentage)
1	2	3	4	5	6
	1995	1482.2	1471.5	(–)10.7	(–)0.7
	1996	1482.2	988.9	(–)493.3	(–)33.3
	1997	1482.2	1463.3	(–)18.9	(–)1.3
	1998	1482.2	1279.8	(–)202.4	(–)13.7
	1999	1482.2	1433.8	(–)48.4	(–)3.3
	2000	1482.2	1022.8	(–)459.8	(–)31.0
	2001	1482.2	1611.0	(–)128.8	(–)8.7
	2002	1482.2	1006	(–)476	(–)32.1
	2003	1482.2	1668	(+)186	(+)12.6
	2004	1482.2	1276	(–)206	(–)13.9
	2005	1482.2	1522	(+)40.0	(+)2.7
	2006	1482.2	1682	(+)200.5	(+)13.5

TABLE - 4

Districtwise normal and actual rainfall - 2015

Sl. No.	Year 2015 / Districts	Normal rainfall (in M.M.)	Actual rainfall (in M.M.)	Increase (+) or decrease (–) from Normal rainfall	
				(in M.M.)	(in Percentage)
1	2	3	4	5	6
1.	Angul	1421.1	1344.1	(–)77.0	(–)5.4
2.	Balasore	1568.4	1773.8	(+)205.4	(+)13.1
3.	Baragarh	1527.0	1653.2	(+)126.2	(+)8.3
4.	Bhadrak	1568.4	1350.6	(–)217.8	(–)13.9
5.	Bolangir	1443.5	1718.7	(+)275.2	(+)19.1
6.	Boudh	1597.1	1730.5	(+)133.4	(+)8.4
7.	Cuttack	1501.3	1927.4	(+)426.1	(+)28.4
8.	Deogarh	1527.0	1142.2	(–)384.8	(–)25.2
9.	Dhenkanal	1421.1	1384.6	(–)36.5	(–)2.6
10.	Gajapati	1295.6	1706.3	(+)410.7	(+)31.7
11.	Ganjam	1295.6	1482.6	(+)187.0	(+)14.4
12.	Jagatsinghpur	1501.3	1609.4	(+)108.1	(+)7.2
13.	Jaipur	1501.3	1652.2	(+)150.9	(+)10.1
14.	Jharsuguda	1527.0	1258.0	(–)269.0	(–)17.6
15.	Kalahandi	1378.2	2244.3	(+)866.1	(+)62.8
16.	Kandhamal	1597.1	2369.8	(+)772.7	(+)48.4
17.	Kendrapara	1501.3	1426.4	(–)74.9	(–)5.0
18.	Keonjhar	1534.5	1551.2	(+)16.7	(+)1.1
19.	Khurda	1449.1	1685.2	(+)236.1	(+)16.3
20.	Koraput	1521.8	1952.4	(+)430.6	(+)28.3
21.	Malkangiri	1521.8	1917.4	(+)395.6	(+)26.0
22.	Mayurbhanj	1648.2	1821.3	(+)173.1	(+)10.5
23.	Nabarangpur	1521.8	2151.6	(+)629.8	(+)41.4
24.	Nayagarh	1449.1	1379.8	(–)69.3	(–)4.8
25.	Nuapada	1378.2	1449.6	(+)71.4	(+)5.2
26.	Puri	1449.1	1932.7	(+)483.6	(+)33.4
27.	Rayagada	1521.8	1977.2	(+)455.4	(+)29.9
28.	Sambalpur	1527.0	1790.7	(+)263.7	(+)17.3
29.	Sonepur	1443.5	1685.0	(+)241.5	(+)30.6
30.	Sundargarh	1647.6	1213.6	(–)433.8	(–)26.3

Source : *Board of Revenue, Odisha*

Odisha enjoys tropical climate. Monsoon rainfall is of highest importance because it directly controls the agriculture of the state. About 80% of the total annual precipitation is received during the monsoon seasons. Hence, the variation of rainfall affect the agriculture of Odisha. Its distribution is not uniform. There are several spells of heavy rains and several spells of lulls. Odisha experiences four main seasons as per the Meteorological Department of the Government of India. They are as follows :

(a) Seasons on the NE Monsoons

1. January and February (Cold weather)
2. March to mid-June (Hot weather)

(b) Seasons of SW Monsoons

3. Mid-June to Mid-September (General rain)
4. Mid-September to December (Retreating monsoon)

From 1995 to 2015 the actual rainfall in Odisha (in mm) was less than the expected normal rainfall (1482.2 mm). But in 2001 the actual rainfall was 1611.0 mm against the normal rainfall of 1482.2 which was blessing for the farmers. Please refer table no. 4.

NATURE AND SIGNIFICANCE OF MONSOON RAINS

The seasonal character of monsoons is the most significant factor influencing the life of people in several ways. Odisha is predominantly an agricultural state. The agricultural seasons in Odisha are related with monsoons. The onset of monsoon marks the beginning of Kharif season, while the Rabi season begins with the retreat of south-west monsoons. The type of crop grown in a region is related in a big way with the amount of rainfall. Hence, humid crops such as rice and jute are cultivated mostly in the coastal regions, while the sub-humid or dry crops such as cotton, wheat and millet in the interior regions.

The El Nino is an oceanic atmospheric phenomenon which causes waters in the equatorial pacific to warm up abnormally. It is a cyclical phenomenon emerges after a gap of about 2 to 5 years. El Nino or warming of sea surface temperature affects wind patterns. El Nino affects rainfall during monsoon months with uneven distribution monsoon months result less rainfall due to weakness. the prominent drought in India in 2002 and 2009 was due to the influence of El Nino.

The erratic nature of the monsoon rains occasions drought that occur once every five years on an average. Droughts affect about 35 per cent of the country's area receiving less than 75 cm of rainfall on an average and with poor irrigation facilities.

Further, the irregularity of the monsoons has made Odisha one of the worst flood affected state in India. Heavy rainfall, cyclones, the overflowing of river waters, an elevation of the river beds, changes in the course of river and poor drainage facilities cause floods every year in about 25 to 50 per cent of the 2.42 crore hectare land identified as prone to floods. (We will know more of floods, droughts, cyclones and other natural disasters associated with climate in the Chapter-6.

Despite climatic contrasts and variations, the monsoons provide a rhythmic cycle of seasons in the state year after year. Odisha landscape, its animal and plant life, its entire agricultural calendar and the total life of the Odisha people, including their festivities, revolve around the rhythmic cycle of seasons. Although monsoons are characterised by their most uneven distribution of rainfall in the state, they are interestingly responsible for bringing highly moist marine air to almost every part of Odisha, at least for a few weeks no matter whether it results in rain or not.

CLIMATIC REGIONS

According to 'Koppers' classification' the climate of Odisha is the tropical savannah type (AW). As per 'Thorntha waite's classification', Odisha comes under the moist-subhumid and dry sub-humid category, implying deficient winter rains. Stamp has included Odisha in NE plateau and the Ganga valley type where heavy rainfall and considerable humidity is experienced. Odisha lies under tropical savannah type (AW) as per Trewartha's climatic regions. As per S.B. Chatterjee's classification, the coastal region of Odisha is included in the tropical savannah type of climate.

AGRO-CLIMATIC ZONES IN ODISHA

Odisha can be divided into ten agro-climatic zones on the basis of soil, weather and other relevant characteristics. Its land can be classified into three categories, low (25.6%), and up-lands (40.8%) with various types of soil like red, yellow, red-loamy, alluvial, coastal alluvial, laterite and black soil etc. with low and medium texture. Characteristics of different agro-climatic zones in Odisha are presented in Table–5.

TABLE – 5

Agro-climatic Zones in Odisha

Sl. No.	**Agro-climatic zone rainfall (in mm)**	**Climate**	**Mean annual**	**Soil group**
1	**2**	**3**	**4**	**5**
1	North western Plateau	Hot and moist	1648	Red and yellow
2	North central Plateau	Hot and moist	1535	Red loamy
3	North eastern coastal Plateau	Hot and moist sub-humid	1568	Alluvial
4	East and south eastern Plateau	Hot and moist	1449	Coastal alluvial saline (near the coast line)
5.	North eastern ghat	Hot and moist sub-humid	1597	Laterite and brown forest
6.	Eastern ghat high land	Warm and	1522	Red
7.	South eastern ghat	Warm and humid	1522	Red, mixed red and yellow
8.	Western undulating	Warm and moist	1527	Black mixed red and black
9.	West central table land	Hot and moist	1527	Red, heavy textured colourous
10.	Mid central table land	Hot and dry sub-humid	1421	Red loamy, laterite, mixed red and black

Source : *Directorate of Economic and Statistics.*

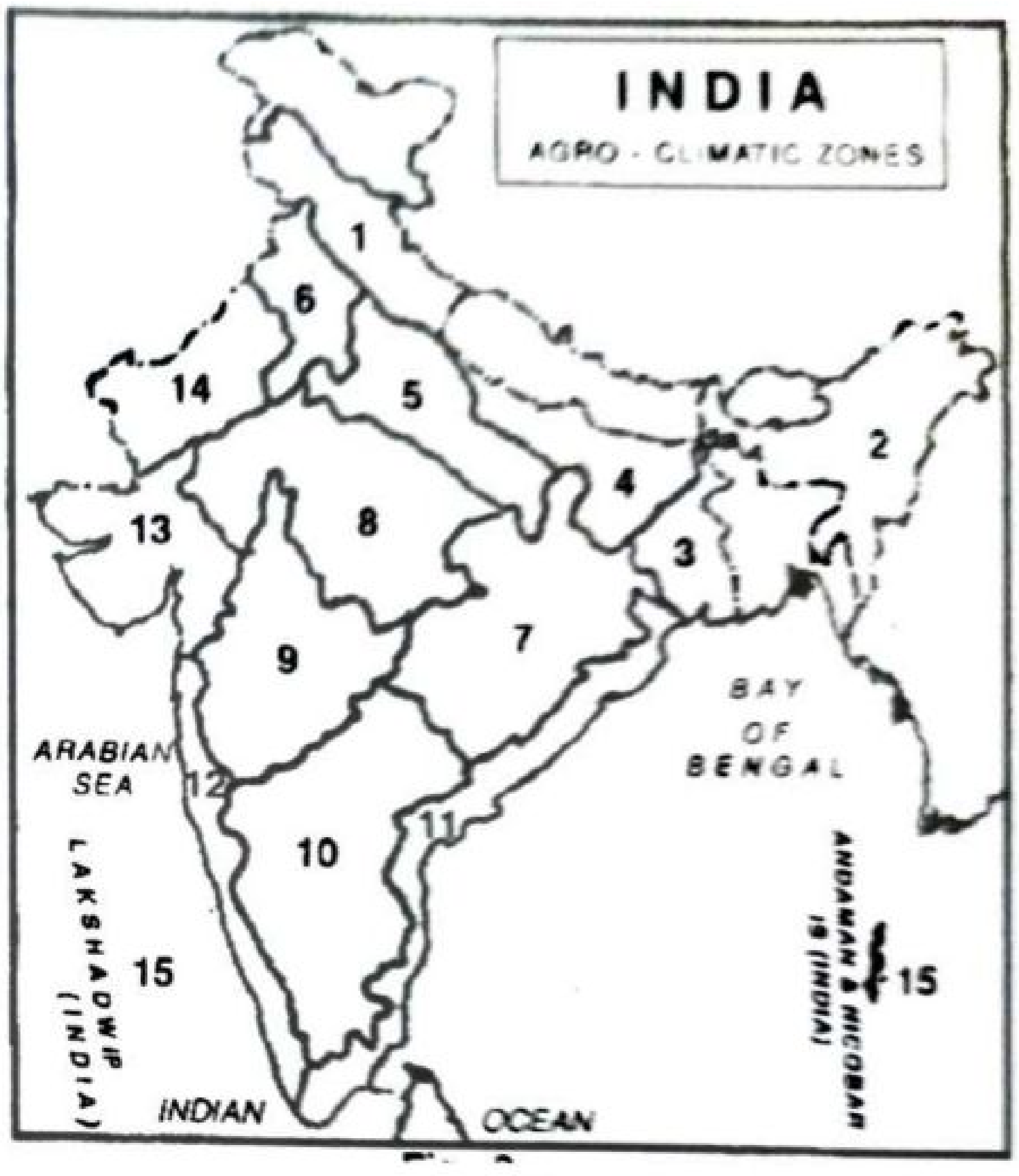

Fig.–2

Based upon Survey of India Outline map printed in 1999.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

The boundary of Meghalaya shown on this map is as interpreted from the North-eastern Areas (Reorganisation) Act, 1971, but has yet to be varified.

Responsibility for correctness of internal details shown on the map rests with the publisher.

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PARAMETERS OF DEVELOPMENT

There are three parameters of development : (i) Natural Environment, (ii) Technology, (iii) Institutions.

(i) Natural Environment : Natural environment indicates the direction of economic development. The areas endowed with rich natural resources have more, opportunities for development at the given level of technology. On the other hand, areas poor in natural wealth remain underdeveloped. Natural environment also decides the type of economic activity carries out by the inhabitants of a particular area. For example, people in the river valleys practise agriculture lumbering is practised in forested regions and fishing in the coastal regions.

(ii) Technology : It is the art of interacting with the environment. The extent of production levels in all these activities are limited by the level of technology available to the people in the respective regions. Technology has its own characteristics. Primitive technology is size neutral and is available to all irrespective of their income levels. Intermediary technology is size biased and is available only to those who have some investible surplus. Sophisticated and large scale technology has to be brought under social control because of its high cost. This large scale technology is available to all irrespective of their size after a nominal payment. The intermediary technology creates disparities in income within a social group and across the regions.

(iii) The Institutions : The institutions have been created by human beings for accelerating the pace of economic development. Institutions should be modified and changed with the passage of time because rigid institutions cause deceleration rather than acceleration of the pace of economic development.

The level of economic development is the function of the harmonious interaction between natural environment, technology and the institutions created in a region.

6

NATURAL CALAMITIES ASSOCIATED WITH CLIMATE

☞ **Tropical cyclones** ☞ **Drought** ☞ **Floods**

Odisha is an important state located in the eastern part of India. Any natural calami in Odisha has to be reviewed in relation to the geography of India specially **flood and cyclon** In August, 2008, the river Brahmaputra flooded many parts with extensive damage to life an property in the state of Assam. This river has its source at Tibbet outside Indian territory bu flooding the state of Assam in the rainy season with nearly 8 km. wide channel. So also the rive Kosi in the state of Bihar has its source in eastern Nepal outside Indian territory. In August, 200 the river Kosi was notorious for shifting its course and causing damage to life and propert through extensive flood. The river Subarnarekha originated in the southern slope of Chhotanagpu plateau in the state of Jharkhand, brought the disastrous flood in August, 2008 in its lowe reaches – Jaleswar, Bhograi, Baliapal in the Balasore district of Odisha. The road and trai communications were disrupted for several months. The tropical cyclone that affects Odisha i also originated in the **Bay of Bengal** or in **Indian Ocean**. So natural calamity in Odisha has t be reviewed with disaster impact assessment in the national level according to rainfall, wind direction and topographical feature of India.

A cyclone is an area of low atmospheric pressure. The pressure is lowest at the centre. It is a storm system of great intensity. This closed air circulation is caused by atmospheric disturbances over and above the earth's surface, coupled with the earth's rotation which imparts a whirling motion to these disturbances. Cyclones are associated with destructive and violent disturbances, such as heavy squalls and torrential rainfall.

Winds in a cyclone in the northern hemisphere spiral inwards in an anti-clockwise direction, and in the southern hemisphere, in a clockwise direction.

Depending on their area of origin and principal tracks followed, the cyclones can be either temperate/extra-tropical or tropical.

TROPICAL CYCLONES

Tropical cyclones, the most destructive of nature's phenomena, are known to form over all tropical oceans, except South Atlantic and the South Pacific, during certain seasons. These cyclones have a thermal origin. They are believed to form in the Inter-Tropical Convergence Zone (ITCZ), a narrow belt at the **equator**, where the trade winds of the northern and southern hemispheres meet. ITCZ is a region of high radiation energy which supplies the necessary heat for the vaporisation of sea water into the air. This moist unstable air rises, generates convective clouds and leads to an atmospheric disturbance with a fall in surface atmospheric pressure. This causes a convergence of surrounding air towards this region of low pressure.

The converging mass of air gains a rotary motion because of what is known as the Coriolis force caused by the rotation of the earth. However, under favourable circumstances, such as high sea-surface temperatures, this low pressure area can get accentuated. The convective instability builds up into an organised system with high speed winds circulating around the low pressure interior. The net result is a well-formed cyclone.

The ideal conditions for the development of tropical cyclones are-(i) quiet air, (ii) high temperature, (iii) highly saturated atmospheric conditions.

Tropical cyclones never originate over land, although they often penetrate far into the margins of continents. But they soon lose their strength after crossing the coast and penetrating inland.

Major Breeding Grounds : The major areas affected by Cyclones are—

(i) South-east Carribean region where they are called *hurricanes.*

(ii) Philippines islands, eastern China and Japan where they are called *typhoons.*

(iii) Bay of Bengal and Arabian Sea where they are called *cyclones.*

(iv) Around south-east African coast and Madagascar-Mauritius islands.

(v) North-west Australia.

CHARACTERISTICS

The main features of tropical cyclones are as follows :

Size and Shape :

Tropical cyclones have symmetrical elliptical shapes (2·3 ratio of length and breadth) with steep pressure gradients. They have a compact size–80 km near centre, which may develop upto 300 km to 1,500 km.

Wind velocity and Strength :

Wind velocity in a tropical cyclone is more in poleward margins than at centre and is more over oceans than over landmasses, which are scattered with physical barriers. The wind velocity may range from nil to 1,200 km per hour.

Orientation and Movement :

These cyclones start with a westward movement, but turn northwards around 20° latitude. They turn further north eastward around 25° latitude, and then eastwards around 30° latitude. They then lose energy and subside. Tropical cyclones follow a parabolic path, their axis being parallel to the isobars.

Structure :

The centre is characterised by a patch of clear sky, called eye of *cyclone*. Here, because of the dry, descending air, quiet conditions prevail. Outwards of the centre, there are cirrus clouds and still outwards, dark nimbus clouds, which cause occasional torrential downpour and thunder storms. The right hand back corner of the cyclone gets heavy squalls and rainfall, but the left hand back corner gets clear weather as the trough passes. These cyclones are associated with destructive weather conditions, especially at the front of the cyclone. Also, these cyclones are high unpredictable as the thermal effect over ocean and coastal areas changes very rapidly.

Associated Weather :

The arrival of a tropical cyclone at a particular place is marked by a sudden increase in air temperature and wind velocity, decrease in air pressure, appearance of cirrus or cirrostratus clouds in the sky, and emergence of high waves in the oceans. These clouds thicken and become cumulonimbus, and torrential rains begin. Giant waves spring up and the spray blows in continuous sheets which reduces visibility almost to zero.

This terrible storm continues for few hours and is abruptly followed by total calm and clear skies. This happens when the 'eye' of the cyclone arrives. Temperature rises, but the pressure is at its lowest. The eye is merely a hollow vortex produced by the rapid spiralling of air in the storm. The period of calm lasts for half an hour, and the weather suddenly changes with the arrival of the rear or the tail of the cyclone. The sky becomes overcast again; there is heavy downpour accompanied by lightning and thunder. Winds of high velocity again set in but this time in reverse direction to those of the first half of the storm. This situation continues for few hours, then gradually the winds abate, the clouds break and fair weather returns.

Impact :

Severe tropical cyclones cause considerable damage to life, property and agricultural crops. The principal dangers posed are– (a) fierce winds, (b) torrential rains and associated flooding, and (c) high storm tides (combined effect of storm surge and tides).

While gales and strong winds as well as torrential rain cause sufficient havoc to property and agriculture, loss of human life and cattle is mainly due to storm surges. If the terrain is shallow and shaped like a funnel, like that of Bangladesh-much of the exposed land is just about at the mean sea level or even less-storm surges get enormously amplified. Coastal inundation due to a combination of high tide and storm surge can cause the worst disaster.

Tropical Cyclones in the Indian Ocean and Bay of Bengal Regions :

The frequency, intensity and coastal impact of cyclones vary from region to region. Interestingly, the frequency of tropical cyclones is the least in the north Indian Ocean regions of the Bay of Bengal and the Arabian Sea; they are also of moderate intensities. But the cyclones are deadliest when they cross the coast bordering north Bay of Bengal (coastal areas of Odisha, West Bengal and Bangladesh). This is mainly due to storm surges (tidal waves) that occur in this region inundating the coastal areas.

Tropical cyclones over the Bay of Bengal affecting Odisha occur in two distinct seasons, the pre-monsoon months of April-May and the post-monsoon months of October-November. On an average, in fact, almost half a dozen tropical cyclones form in the Bay of Bengal and the Arabian Sea every year, out of which two or three may be severe. Out of these, the stormiest months are May, June, October and November. Compared to the pre-monsoon season of May-June, when severe storms are rare, the months of October and November are known for severe cyclones.

Tropical cyclones in the Bay of Bengal affecting Odisha are more frequent than in the Arabian Sea. There could be three reasons for this–(i) waters in the Bay of Bengal are comparatively shallow; (ii) the coastline along the Bay of Bengal is more complicated; and (iii) more number of rivers drain into the Bay of Bengal than into the Arabian Sea.

Two major natural disasters like severe cyclones of 1971 and super cyclone of 1999 not only took heavy toll of about 19660 people and thousands of livestock but also badly affected more than 50 lakhs people in their livelihoods and made them homeless in Odisha.

The very severe cyclonic storm, "PHAILIN", on 12th October, 2013 and very severe cyclonic storm "HUDHUD" on 12th October, 2014 extensively devasted the economy of coastal, southern and part of western region of Odisha.

The phailin followed by flash floods in October, 2013 adversely affected about 132.36 lakh people in 195 blocks in 19 districts of the state. It not only affected total cropped area of about 11 lakh hectare with an estimated loss of Rs.2,300 crore, but also damaged the houses, livelihoods, economy, agricultural and physical infrastructure with gigantic magnitude. The hazard resulted is negative growth of agriculture sector during 2013-14.

Cyclone continued to grip Odisha even during 2014-15. The very severe cyclonic storm HUDHUD hit 16 districts of Odisha namely Ganjam, Gajapati, Puri, Nayagarh, Khorda, Cuttack, Jagatsingpur, Kendrapara, Jajpur, Balasore, Mayurbhanj, Keonjhar, Bhadrak, Dhenkanal, Koraput and Malkangiri. For the first time, certain southern districts particularly the tribal districts, which has never before came across a cyclonic storm, experienced such a high wind speed. Odisha Disaster Rapid Action Force (ODRAF), National Disaster Response Force (NDRF), Fire Services teams and police personnel acted admirably on evacuation, search, rescue, relief operations and road clearance etc. About 33.44 lakh people in 99 Blcoks and 37 ULBs of the state were affected by the cyclone HUDHUD with large scale house damage and crop damage and livelihood losses by fishermen, rural artisans, handloom weavers etc. The state is also victim of other natural calamities. During 2016-17 (as on 31st December, 2016) the human death tolls due to lightening, sunstorm and hailstorm were 380, 47 and 9 respectively. This is a matter of serious concern.

Tropical cyclones over the Bay of Bengal affecting Odisha occur in two distinct seasons, the pre-monsoon months of April-May and the post-monsoon months of October-November. On an average, in fact, almost half a dozen tropical cyclones form in the Bay of Bengal and the Arabian Sea every year, out of which two or three may be severe. Out of these,

the stormiest months are May, June, October and November. Compared to the pre-monsoon season of May-June, when severe storms are rare, the months of October and November are known for severe cyclones.

Minimising the Impact

With the existing knowledge about cyclones, it is not yet possible to physically prevent the build-up of a massive cyclone.

Accepted technology, therefore, only provides the capability to detect and track cyclones with sophisticated satellite, imagery and ground-based radar systems. But here too the limitations are glaring. Atmospheric science, for example, is not yet in a position to unambiguously predict the motion and behaviour of a cyclone more than 24 hours ahead of its arrival. In such a brief span of time, the vulnerable sections of the population can merely be warned of the imminent danger and evacuated to safer/cyclone-withstanding structures.

INDIAN EFFORTS TOWARDS A CYCLONE WARNING SYSTEM

India, according to the World Meteorological Organisation, suffers only six per cent of the total cyclones worldwide. China and Japan face upto 30 per cent (calling them typhoons), and the Americas 23 per cent (hurricanes). But these regions do not suffer such massive devastation. Clearly, there is a way to prevent it. But that needs a comprehensive disaster-management policy.

India has an efficient cyclone warning system. Tropical cyclones are tracked with the help of (i) regular observation from weather network of surface and upper air observation stations, (ii) ships' reports, (iii) cyclone detection radars, (iv) satellites, and (v) reports from commercial aircraft.

About 280 ships of merchant fleet have meteorological instruments for taking observations at sea. A network of ten cyclone detection radars have been set up along the coast at Kolkata, Paradeep, Visakhapatnam, Machilipatnam, Chennai, Karaikal, Cochin, Goa, Mumbai and Bhuj. The range of these radars is 400 km. When the cyclone is beyond the range of coastal radars, its intensity and movement is monitored with weather satellites.

Warnings are issued by the area cyclone warning centres located at Kolkata, Chennai and Mumbai, and cyclone warning centres at Bhubaneswar, Visakhapatnam and Ahmedabad.

The IMD still largely depends on DOT's telegraph and telecommunication channels

The IMD still largely depends on DOT's telegraph and telecommunication channels for transfer of data to area cyclone centres as well as dissemination of warnings to various users like district collectors, state government officials, etc. As the storm approaches the coast many of these channels completely breakdown.

To overcome these difficulties, IMD has developed a system known as Disaster Warning System (DWS) to transmit cyclone warning bulletins through INSAT-DWS to the recipients. This consists of the following elements :

(i) The cyclone warning centre for originating the area code of the districts and disaster warning message.
(ii) The earth station located near the cyclone warning centre with uplink facility in C-band and suitable communication links.
(iii) The C/S band transponder on board INSAT.
(iv) The INSAT-DWS receivers located in cyclone prone areas.

The IMD has also published the tracks of the cyclones since 1891 and updates them every year in its quarterly scientific journal, *Mausam*.

Typically, in a cyclone the maximum devastative effects are within about 100 km from the centre and on the right of the storm track where all the islands lie. Evacuating the population just 24 hours before would require an army of high speed boats, an unfeasible proposition for a resource-poor country.

The obvious solution, therefore, would be to provide a large number of storm shelters in the particularly vulnerable areas.

DROUGHT

In simple terms a 'drought' is a condition of dryness due to lack or shortage of water over an extended period. It can be defined according to meteorological, hydrological or agricultural criteria.

In meteorological terms, a drought is "a sustained and regionally extensive deficiency in precipitation". According to the definition of meteorological drought adopted by the Indian Meteorological Department (IMD), a drought is a situation when the deficiency of rainfall at a meteorological sub-division level is 25 per cent more of the long-term average (LTA) of that sub-division for a given period. If the deficiency is between 26 per cent and 50 per cent, the drought is considered 'moderate', and if the deficiency is over 50 per cent, the drought is termed 'severe'.

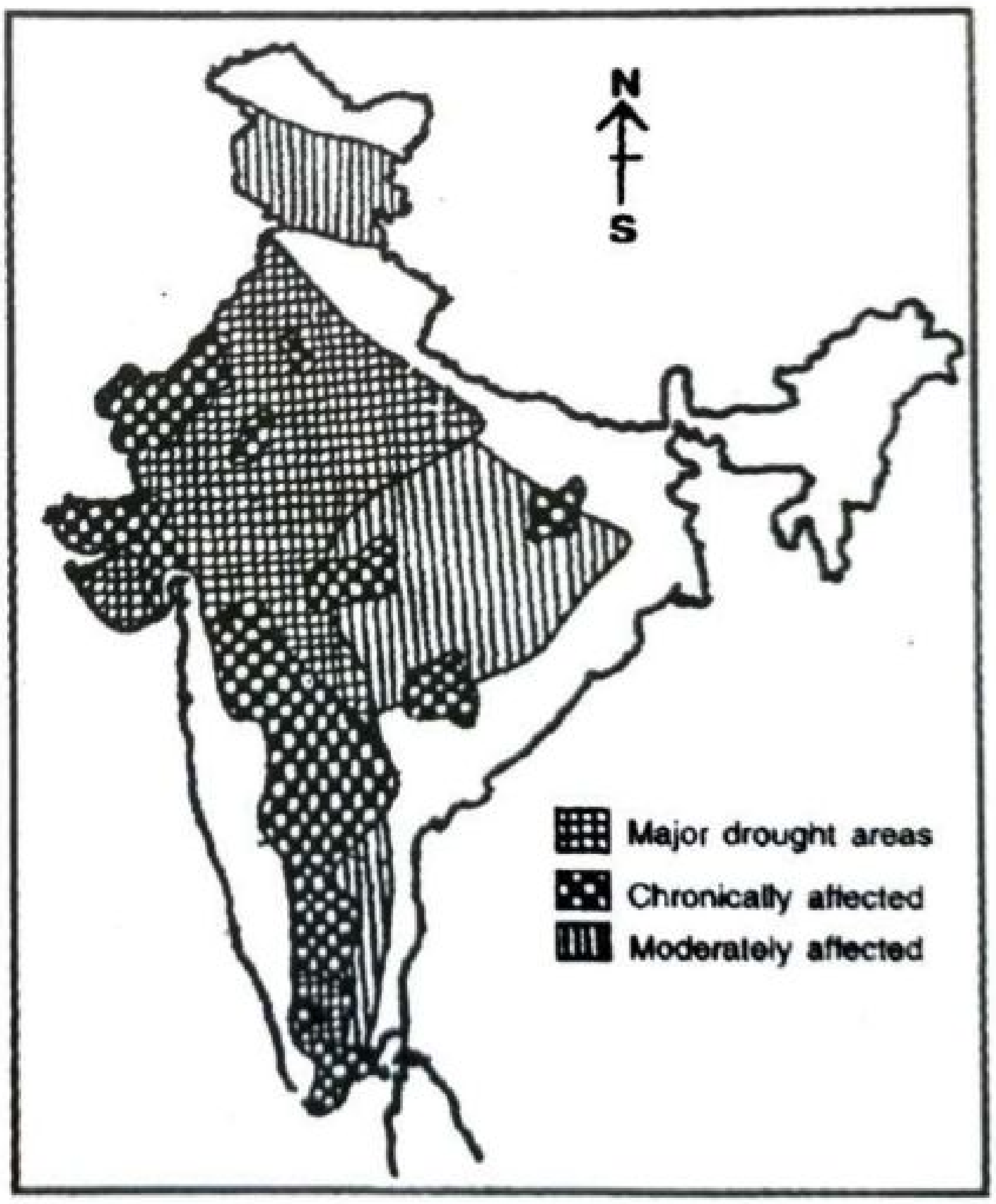

Fig. 3

Sketch map of INDIA : Drought Prone Areas

In India, the south-west monsoon accounts for the most (about 70-80 per cent) of the rainfall and is the main source of water. The meteorological drought is only a representation of the rainfall distribution pattern and statistics.The hydrological drought is the manifestation of critically low groundwater tables and a marked reduced river and stream flow, causing severe shortage of water for livestock and human needs.

An agricultural drought results when soil moisture and rainfall are inadequate durin the crop growing season to support healthy crop growth to maturity. The National Commissio on Agriculture has defined an agricultural drought as a period of four consecutive weeks (o severe meteorological drought) with a rainfall deficiency of more than 50 per cent of the LTA o with a weekly rainfall of 5 cm or less during the period from mid-May to mid-October (th Kharif season) when 80 per cent of the country's total crop is planted, or six such consecutiv weeks during the rest of the year.

The intensity of drought is guided by several factors, viz., the degree of rainfal deficiency, the length of dry periods, the size of the affected area, and the availability of variou facilities including irrigation. Of late the "Palmer Drought Severity Index" is commonly brough into use for expressing the severity of drought. The index ranges from +6 (very much wette than normal conditions) to –6 (severe drought). The index measures the relative dryness o local weather within successive periodic intervals. It considers the differences of actua precipitation from the minimum amount of precipitation required in normal conditions to sustai evapotranspiration, run off and storage of moisture in a given climatic region.

In India, drought remains a recurrent phenomena in spite of its vast water resource India has several major, medium, and minor rivers. The annual rainfall and snowfall is abou 114 cm which creates 4,000 cu km of water per annum. Even after evaporation and othe losses, about 1,870 cu km of water should remain as excess. But in reality, only 700 cu k surface water reserve remains usable owing to topographical and hydrological bottlenecks.

Out of about 6 million villages of India about 2,31,000 are called 'problem villages' In these 'problem villages' water is not available within a 1.6 km radius. Almost 68 per cent o the sown area is dependent upon rainfall. Rainfall distribution grossly varies in more tha 35 meteorological subdivisions of India. For example, Cherrapunji receives about 118.70 cm o rainfall in comparison to about 10 mm or less rain received in the western part of Rajasthan. The most drought-prone regions is located in West Rajasthan, Gujurat, Saurashtra and Kutch. Maharashtra, Telengana, Rayalaseema, Bihar and some parts of Odisha, such as Kalahandi. Bolangir and Koraput.

MAJOR INCIDENCES OF DROUGHT IN INDIA

The worst drought experienced by India occurred in 1877. The rainfall departure in 1877 was –79 per cent which has a spread of over 66.8 per cent of the area. In recent times droughts have occurred in 1979, 1982, and as close as 2000. The drought of 1979 had an adverse impact on about 200 million people in Eastern Rajasthan, Himachal Pradesh, Punjab and Andhra Pradesh. The drought of 1982 was characterised by monsoon departure of –13.7 per cent and having an adverse affect on 46.4 per cent of the area and almost 100 million people of

Rajasthan, Punjab and Himachal Pradesh. A 'phenomenal' drought took place in 1987 when the departure of rainfall was 19.3 per cent and the area suffering from deficient rainfall was 64.3 per cent. Among the victims were about 285 million people and 168 million cattle in 15 States and 6 Union Territories, Saurashtra, Kutch, Diu, the western part of Rajasthan, Delhi and Haryana suffered tremendously.

The occurrence of drought does not always have a link with the occurrence of rainfall in a particular region. In recent years, Cherrapunji which receives the highest amount of rainfall in the world was also facing drought conditions due to lack of water harvesting methods.

In the first quarter of the year 2000, large parts of the country were hit by drought. Some fourteen states reported drought or drought-like conditions of verying magnitude. The worst hit were Rajasthan (in which 2.6 crore people in 23,000 villages in 26 districts were affected), Andhra Pradesh (3 crore people in 17,000 villages in 18 districts) and Gujurat (2.5 crore people in 8,000 villages in 17 districts). Parts of Madhya Pradesh, ODISHA, Maharashtra, Manipur, Mizoram and Tripura also came under some stress, as did some districts of Himachal Pradesh, Jammu and Kashmir, Karnataka and West Bengal which reported severe scarcity of water.

What Led to the Drought in 2000 ?

The drought in 2000 was a result of a combination of several factors. Deficient rainfall in some regions of the country was the only natural cause. The more serious were the man-made factors-poor (or no) water management strategy, indiscriminate exploitation of surface water and ground water by industries and the agricultural sector, large-scale deforestation and non-eco-friendly development projects. Analysis believe the man-made factors heightened beyond limits the impact of the natural cause. Had there been proper strategies in place to control the man-made factors, the drought would not have assumed the status of a grave natural calamity.

Rainfall Deficiency :

In the meteorological sense, rainfall deficiency was, no doubt, a cause of the present drought but it was not a major factor. On an all-India level, there was a deficiency in monsoonal rainfall, but its quantum was not much. According to official data, 67 per cent of meteorological sub-divisions or districts (or 28 districts out of the 35 districts) in the 1999 monsoon received normal or excess rainfall. This was less than the 81 per cent in 1998 and 1997, but was comparable with the monsoons of 1992. (65 per cent). The actual rainfall as proportion of normal rainfall was 96 per cent in 1999, higher than in 1991 (91 per cent) in 1992 (93 per cent).

A look at the monsoonal rainfall data for the last couple of years in the regions affected by the early 2000 drought also shows that though the monsoonal rainfall was below normal, the deficiency was not all that severe. Thus, the drought has been the result of deficient rainfall other than the monsoonal one. In Gujurat and Rajasthan, the post-monsoonal rainfall (October-December) was above normal, but the winter (January-February) and pre-monsoonal rains (March-May) in 2000 were severely deficient. In Andhra Pradesh, post-monsoonal rainfall-whose LTAs are substantially high unlike in other regions-in 1999 was highly deficient and so was the pre-monsoonal rainfall in 2000. Though winter rainfall was sufficient in the state, it accounted for a small fraction of the annual rainfall.

Excessive groundwater depletion :

Strictly speaking, the meteorological factor was a cause of "severe drought" only in the Kutch region of Gujurat and Rajasthan. Other regions of Gujurat and Rajasthan and Andhra Pradesh suffered from a severe hydrological drought rather than a meteorological drought. Of grave-concern is the fact that the hydrological drought is not just the natural result of the meteorological drought. Rather, it is more the result of a lack and/or failure of water management practices and planning in traditional water-scarce areas. It points to the fact that withdrawal of water from various resources of such regions-which get recharged only by rainfall-has been unsustainably high in recent times leading to a drastic depletion of these resources.

Many analysts feel the situation in early 2000 should be described by the term 'water scarcity' rather than a 'drought'. While drought is a natural phenomenon, water scarcity is caused by human mismanagement through populism and poor governance and will keep worsening until management improves.

R. Ramachandran points out in an article in *Frontline* that almost 90 per cent of the drinking water needs are met from groundwater but only five per cent of the total groundwater extracted is needed for domestic use. Irrigation accounts for 85 per cent, and the remaining ten per cent is used by other sectors, including industries. The rapid increase in groundwater-based irrigation using tube wells that are more than 150 m deep and high-power pumps in recent times is one of the many reasons for groundwater depletion and the drop in the groundwater table. The area covered by groundwater-based irrigation has increased from 6.5 million hectare (mht) in 1950-51 to 40 mha. An annual decline in the water table of up to 2 m is considered normal and can cope with even a deficient rainfall the following year. A decline of up to 4 m is a cause for concern and above 4 m is a stress situation. However, there were reports that unregulated overdraft has resulted in water tables dropping 10 to 20 m in several areas in Gujurat.

Technology development in deep drilling and pumping methods (even up to 250 m), on the one hand, and populist policies of free or low-cost electricity for irrigation purposes, on the other, have contributed greatly to this massive exploitation of groundwater for irrigation purposes. Coupled with the highly anomalous policy that vests rights to groundwater with the owner of the land, there is no legal limit on the volume of water that a landowner can extract. Unregulated exploitation by rich farmers with large land holdings, who can afford large pumps, leave the poor and the marginal farmers without access to even basic water needs. Landlords become waterlords, resulting in inequity and social conflicts in rural communities.

Industries, too, exploit groundwater in an unregulated manner. Industries are located where groundwater is indicated and groundwater gets consumed within the industrial premises for different purposes, including dilution of effluent waste. This rapid groundwater depletion has not only reduced water availability but also affected its quality in terms of excess fluoride and arsenic content and blackishness.

It has been pointed out that nearly 90 per cent of groundwater exploitation occurs through private hands. Though a model bill to regulate the development of groundwater has been circulated to all the states.

A belated waking-up :

What heightened the impact of the drought was the failure on the part of the state governments concerned to respond early to the crisis. The partial failure of the south-west monsoon (and other rainfall) should have forced governments into evolving an action plan for the impending tragedy. For regions like Saurashtra and Kutch as well as western Rajasthan, even the normal pattern of living for people is known to be exacting (with water scarcity being a perpetual ordeal). Given this background, the failure of the state governments to get ready with a substantive contingency plan to grapple with the oncoming drought can only be termed as an appalling breach of duty.

Absence of effective long term planning :

Most of the regions struck with drought are arid regions where water scarcity is a norm. On each occasion water scarcity becomes alarming, the respective governments react with crisis management techniques. There has been no comprehensive study of specific developments that the regions require.

IMPACT

In general, a drought has a devastating impact on crops, leading to food scarcity, malnutrition, epidemics, forced migration, economic destabilisation, loss of lives and social conflicts.

Fortunately enough, a drought in modern times does not lead to famines. There is enough stock of foodgrains with the Food Corporation of India. (In fact, buffer stocks were at a high level of 31 million tonnes kept as emergency reserve.) Also, in present times, foodgrains can be easily moved and people can access them. Provided, of course, they have the money to spend on it because of the previous employment opportunities and vast under-employment and under-payment that is more a practice than exception in rural areas.

On whether the drought will have an impact on the agricultural sector and result in lower income levels, the opinion is divided. On one hand is the view that cash crops like oil seeds and cotton production will be impacted which will, in turn, affect rural income. Though the impact will be more localised and limited to states where the condition is particularly serious- namely Gujurat and Rajasthan- it would not be altogether absent.

On the other hand is the view is that the drought-affected areas are too marginal to make any significant difference to the consumption bowl, and the general yield of food and cash crops has been effected too adversely.

While there may be no short-term impact of the drought on die economy, the long term effects cannot be overlooked. The social and the ecological/environmental damages ar often not quantifiable, further, they are irreversible, so their impacts remain for years together. There are changes in settlement pattern, and the social and living styles. Even a partial failure o crops prompts irrigation that causes pressure on urban centres; creating pressure on urba infrastructure.

There are significant ecological effects-decreased scrub growth, increase in erosio of soils and increased desertification.

FLOODS

Floods may be defined as the, submergence of land not usually covered with water, or an increase in depth of water on land already partially submerged, through a temporary rise in river, lake or sea levels. A river floods when it can no longer contain the discharge from its catchment and the bankfull stage is exceeded. In India, rainfall floods a pretty large area during every rainy season. Flood havocs have always brought misery to millions of people, particularly those living in the rural areas. They destroy crops, houses, roads and railway tracks resulting in valuable loss of resources of the country.

The peculiar nature of India's climate, dominated by monsoons, causes situations where drought and floods may affect different pockets at the same time of the year.

REASONS FOR FLOODS

The main reasons for floods in India are listed below.

Heavy Concentrated Rainfall :

India receives a high average rainfall for a country of its size. Sometimes, upto 15 cm rainfall may hit a place in a single day. Interestingly, the monsoon rains come at a time when the summer season is well at an end and snow-fed rivers of the Himalayas already have an excess of water due to greater accumulation of snow in the mountains. This situation reduces the capacity of rivers to accept any more surface run-off due to rains. As a result, the plains at the north, where river velocity is already reduced, are particularly vulnerable to flooding. Heavy rains lead to a rise in volume of the river load, which causes change in river course. As a result of this, water spills over into adjoining areas which are not able to drain this water out and thus get flooded. North Indian rivers such as Damodar, Kosi, Brahmaputra are known for their proneness to floods. The middle and lower courses of the Brahmaputra are especially flood-prone because of a very gradual gradient which is not able to take the increased load during monsoons.

The peninsular rivers have different reasons for getting flooded, which are related to the nature of topography through which these rivers flow. The peninsular rivers are mature and flow over very hard beds and because of their inability to erode very deep into their beds, they have shallow basins. This makes them prone to flooding in case of heavy concentrated rainfall.

Cyclone and Strong Winds :

Parts of the eastern coast of India are particularly prone to cyclones during October-November. Such cyclones develop as low pressure depressions in the Bay of Bengal and get "sucked in" at the deltas along the east coast in Odisha and Andhra Pradesh. These cyclones come with strong winds and heavy rains which cause extensive damage in a short span of time.

Inadequate Drainage :

The intensity cultivated areas of Punjab and Haryana get easily flooded in case of heavily concentrated rains because of bad drainage.

The vulnerability of flood-prone areas is, aggravated by three factors.

(i) Indiscriminate deforestation in catchment areas and upper reaches results in soil erosion and consequent sitting of river courses, which, again reduces their capacity to absorb more water. This factor is a major cause of worry as far as flooding in Himalayan rivers is concerned. Brahmaputra is particularly affected by silting of its tributaries, Dihang and Lohit.

(ii) Overgrazing, especially in the foothills, leaves the solid without cover. This type of soil cover is easily dislodged by the surface run-off during heavy rains and becomes the cause of silting of river courses. Overgrazing in the hills of Himachal Pradesh, Punjab and Uttar Pradesh has made long stretches of the Himalayan rivers in their lower reaches prone to flooding.

(iii) Unscientific farming practices like shifting cultivation result in loss of vegetation cover and consequent soil erosion. This mode of silting of rivers is evident in north-eastern India where silting of tributaries of the Brahmaputra is a major cause of flooding of the Brahmaputra basin.

DISTRIBUTION OF FLOOD-PRONE AREAS

Among the severely affected areas of the country are the Brahmaputra valley, north Bihar (Kosi river and north Gangetic plain) and lower West Bengal. Apart from these, floods affect large areas in the following belts.

(i) The lower courses of rivers in the north Indian plains get silted and change their courses. These areas lie in the states of Punjab, Haryana, Himachal Pradesh, Delhi, Rajasthan, Uttar Pradesh, Bihar and West Bengal.

(ii) The tributaries of Indus—Jhelum, Satluj, Beas, Ravi and Chenab-cause floods in Jammu and Kashmir, Punjab, Haryana, Western Uttar Pradesh, Himachal Pradesh. Inadequate drainage in parts of Haryana and Punjab is the main cause of inundation.

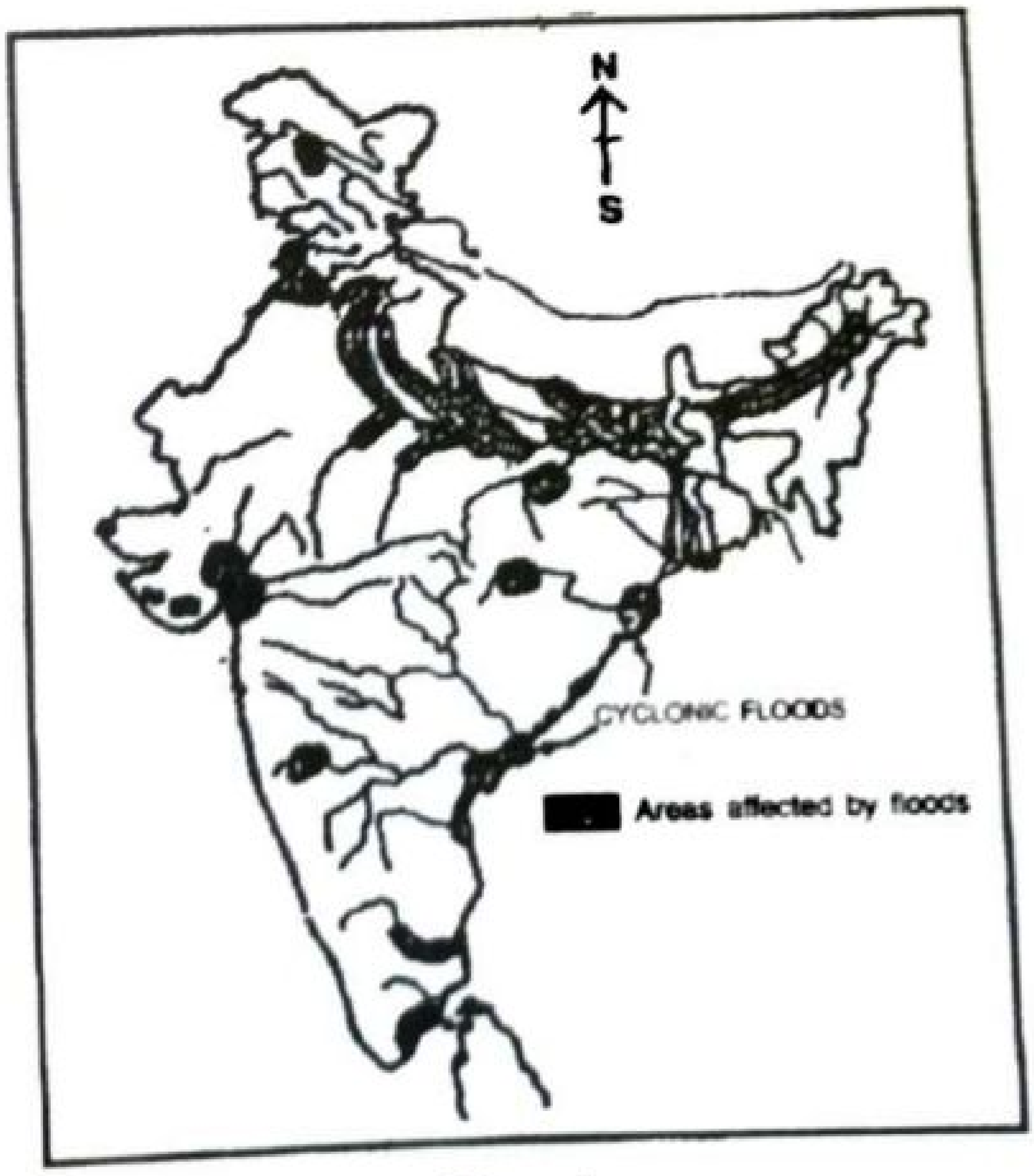

Fig - 4

Sketch map of INDIA : Flood prone areas

(iii) Certain areas in central India, and the peninsula get flooded by Narmada, Tapti, Chambal, Godavari, Krishna, Cavery and Pennar. In Odisha the river Brahmani, Subarnarekha, Kharsuan cause flood havoc.

(iv) Certain areas along the east coast get flooded due to cyclonic storms.

The total area affected by floods in India is between 7.5 million hectares and 10 million hectares. Uttar Pradesh is the worst affected state.

CONSEQUENCE OF FLOODS

The most damaging aspect of flood is the huge loss of human lives. Every year, about 100 lives are lost due to floods. In economic terms, the immediate effect of floods is seen in temporary loss of fertile lands (since most of the flood affected areas is also the most cultivable area). The sowing season, rainy season and the monsoons coincide in India. Although floods bring fertile silt along with them each time, they also cause extensive soil erosion resulting in loss of precious soil cover. The Brahmaputra is particularly notorious for erosion of its banks during the monsoons. Areas with poor drainage, like Punjab and Haryana, which are also intensely cultivated with a high level of assured irrigation and use of chemical fertilisers and pesticides, are vulnerable to salination once the flood waters evaporate during the warm season that follows the rains. The underground salts which have percolated down to lower levels with flood water come out during the warm season through capillary action and give the top soil a fluorescent appearance, while seriously depleting its fertility.

Sometimes river courses are permanently shifted because of floods. This has a long-term effect on land use along river courses. The indirect impact of floods is seen in disruption of rail and road communication, and of essential services.

FLOOD CONTROL MEASURES AND RELATED PROBLEMS

The Indian government has taken various steps to check or minimise the damage cuased by floods.

Storage reservoirs have been built as part of multipurpose projects over several flood-prone rivers. Some of these reservoirs are Konar, Panchet, Maithan and Tilaiya on Damodar river, Hirakud on Mahanadi, Bhakra on Satluj, Pong on Beas, Ukai on Tapti, Nagarjuna Sagar on Krishna.

Between 1954 (when the national Flood Control Programme was launched) and 2007, 34,600 km of embankments and 47,100 km of drainage channels, have been constructed. These measures have provided protection to 430 towns, and 13.4 million hectares of flood-prone areas.

Certain long-term measures include collection of hydrological data and installation of flood warning systems.

These measures, however, have their share of drawbacks and do not, in themselves, provide a comprehensive solution to the menace of floods.

Mere Construction of Storage Reservoirs is not enough :

Extensive soil conservation measures, upstream of the reservoir and around it are required to prevent silting of reservoirs through soil erosion. Silting reduces water holding capacity of reservoirs, thus reducing their efficiency in absorbing the overflow of flood water. According to a study, the rate of sedimentation of reservoirs in India is three times the estimated rate (i.e., estimated when they were built). This has reduced the life of reservoirs in India to one-third. Also in case the floods are caused by heavy rains in the downstream areas, the reservoirs are not effective. For instance, in Punjab in recent years, the Bhakra and Pong reservoirs have hardly been filled to capacity, while torrential rains caused floods downstreams affecting nearly half the state's population.

Embankments are not a Scientific Solution :

Embankments are an unnatural way to check the flow of water. Often, the river level is above the surrounding surface in case of an embanked stream, because silt gets accumulated in the riverbed, instead of spilling over onto the flood plain. The flood plain, as a result, is deprived of fertile silt, year after year. Also, in case a breach occurs in a part of the embankment, the water will gush out at a very high speed and cause more damage than a slowly rising unembanked river in flood. The siltation results in floods even if there is moderate rainfall in the catchment areas. The protection provided by embankments is unstable.

Flood-Plain Zoning is a Reliable and Scientific Method :

Compared to reservoirs and embankments, this is a "non-structural" measure. This method is based on the principle that, "where the river has the right of way, stay out of its way". Flood plain is the boundary or extent of the river movement about its mean course. Topographically, it is lower than the surrounding areas and is more prone to flooding.

Flood-plain zoning means demarcating such zones and preventing indiscriminate development and human settlement in such areas. In 1957, the Central Flood Control Board had mooted the idea of demarcating flood zones and the measures to prevent indiscriminate development and settlement in such areas. In 1975, the Central Government circulated a model bill containing such provisions. It also provided for construction of flood zoning authorities in all the states to take up surveys and demarcation of flood zones or plains. It recommended legislative support to prohibit the use of flood plains and removal of unauthorised constructions. Other states have failed to take the desired steps under pressure from influential builders, developers and other vested interests. States, on the other hand, ask for huge funds for relief measures and not much is done for long-term protection of the flood-prone areas.

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THALLPATHY7

SOILS

- Definition of soil
- Soil Components
- Functions of soil
- Soil texture
- Soil - growth
- Red loam and red sandy soils
- Lateritic soils
- Red and Yellow soils
- Mixed red and Black soils
- Soil solution
- Measurements
- Nature of Colloids and fungi
- Pedology and Edaphology
- Surface soil and sub soil
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- Brown Forest soils
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Definition of soil

Soil may be defined as a natural body developed as a result of pedogenic processes that take place during and after the weathering of rocks and in which plants and other forms of life are able to grow. It foms a loose superficial mantle covering the earth's crust, and is the seat of continual changes and transformations brought about by genetic factors. These changes and transformations make soil a dynamic body or entity.

Pedology and Edaphology

Soils or the pedosphere, are composed of air, water, mineral and organic material and organisms. They can be regarded as an amalgam of the lithosphere, the biosphere, the hydrosphere and the atmosphere as shown diagrammatically in Fig. 5. The amount and types of these constituents vary, widely from place to place over earth's surface causing an almost infinite variability in the types of soils.

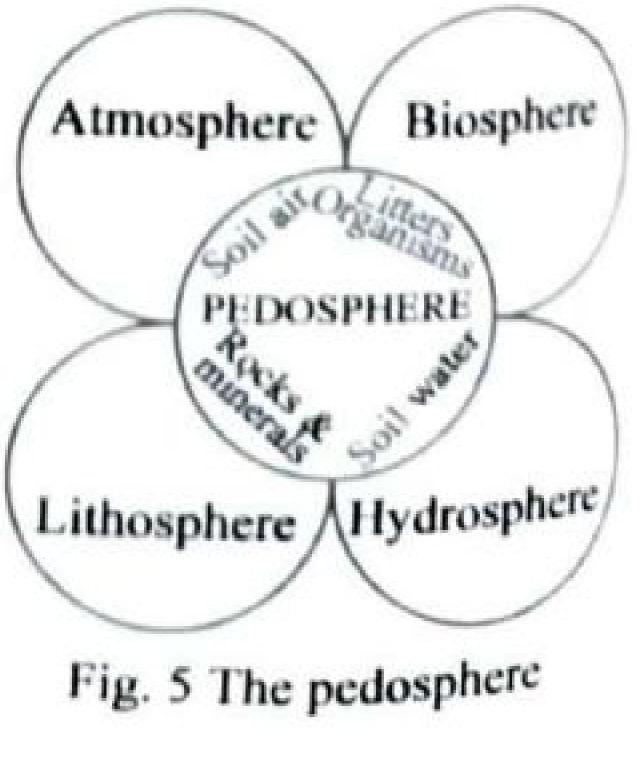

Fig. 5 The pedosphere

Soils are scientifically studied by Pedologist and Edaphologist treating soils as a natural entity a biochemically weathered and synthesized product of natural and as a natural habitat for plants, respectively. Pedology (from Greek word Pedon, means soil or earth - Pedon is the three dimensional sampling unit of size of about 1 to 10 m^2 used for examination and study of the soil in the field. Several continuous pedons with similar characteristic are grouped together in a larger area called a polypedon or individual soil. Several such individual soils are present in land scape - is thus the study of the soil as a natural body and does not focus primarily on the soils of immediate practical use. A pedologist studies, examines and classify soils as they occur in natural environment. While, Edaphology (from Greek word edaphos means soil or ground) is the study of the soil from stand point of higher plants. Edapho-logist consider various properties of soils in relation to crop production (Brady, 1990).

Soil components

Soil is composed mainly of mineral matter together with a small amount of organic matter. In addition to these two, it contains water, some gases, and a large number of organisms. The soil, therefore, may be taken to comprise five groups of materials : (1) mineral matter, obtained by the disintegration and decomposition of rocks; (2) organic matter obtained by the decay of plant residues and animal remains, and microbial tissues; (3) water, obtained from the atmosphere in the form of rain, snow or dew; (4) air or gases, obtained partly from the atmosphere, and partly as a result of the reactions and microbial activity taking place in the soil; (5) organisms, both big (macro) like rodents worms, insects, etc., and small (micro) like bacteria, fungi, etc. which inhabit the soil in large numbers. It is a three phase system in which the mineral and organic matter form the solid phase, the water containing salts and some gases in solution the liquid phase, and the various gases the gaseous phase. Each phase contains a number of constituents which makes the whole system highly complex. On account of the changes continually taking place in the soil, the system is never in equilibrium.

Surface soil and sub-soil

Soils vary in depth from a few centimetres to several hundred, sometimes several thousand metres. In arable soils, cultivation operations like ploughing, harrowing, etc., bring about changes in the upper few cms of the soil. As a results of these operations, two distinct layers are formed. The upper layer of soil through which the implements move during cultivation is known as **surface soil**. The layer below the surface soil extending down to the parent material is known as **sub-soil**. The surface soil is about 22 cm. thick usually forms a part of horizon A. It is usually more loose, and at the same time, more dark or black in colour than the sub-soil. It is in this layer than the greatest number of plant roots is to be found. It is also more rich in organic matter and other plant food elements than the sub-soil. The number of microorganisms in the surface soil is much large than in the sub-soil. The surface soil is, therefore, the seat of greater chemical and biological activities than the sub-soil. Tillage operations, addition of manures, fertilisers and soil amendments and other soil management practices further add to the complexity of activities taking place in surface soil.

Sub-soil varies in depth from a few cms to several hundred metre. It includes horizons B and C, and also the lower part of horizon A wherever this horizon exceeds 22 cm. It is generally lighter in colour than surface soil and is usually more compact. Climatic agents like rain wash down the finer particles from the surface layer into the sub-soil. Rain water also carries in solution several salts as it moves down into the sub-soil and sometimes deposits them there. The sub-soil, therefore, usually richer in fine particles and salts than the surface soil. On account of this behaviour, surface soil contains more coarse particles than sub-soil in humid temperate regions. In arid regions no such differentiation is noticeable, and the two layers are almost uniform. On the whole, the sub-soil is less fertile.

In agricultural practice sub-soil is as important as surface soil. It influences the water and air regime in the soil and thus affects crop production. A compact sub-soil, for instance, impedes the movement of water and brings about stagnation and waterlogging. In such conditions, crop growth suffers due to asphyxiation of plant roots for want of air. The permeability subsoil also influences soil erosion. The erosion hazard is increased or decreased according to the low or high permeability of the subsoil. On the other hand sub-soil provides some of the plant nutrients, especially those in which the surface soil is deficient, and thus contributes to an increase in soil fertility.

While surface soil is highly dynamic due to the continual changes taking place in it, the sub-soil is usually less dynamic and very often stable or static.

Functions of soil

Soil has a three-fold function to perform : Physical, chemical and biological.

One of the important physical functions of soil is to act as a mechanical support for the growing plant. The plant is able to stand erect because of the hold exerted by the soil on plant roots. The roots are ramified and they are thus anchored in the soil mass. The soil acts as reservoir of water and air. The plants absorb water through their roots from this reservoir, and the roots breathe in oxygen from the air stored in soil mass. The soil also stores the suns heat, and supplies it to the growing plant.

Soil Morphology - Colour

The soil profile is not uniform throughout its depth. It contains two or more horizons, each possessing certain morphological features that distinguish one from the other. The same morphological features that differentiate the various horizons also characterise a soil profile and help to differentiate it from others. The more common morphological features are colour, texture, structure, constitution, new growth and inclusions.

The colour of the soil is one of the most outstanding morphological features that attracts one's attention. Very often the various horizons are differently coloured. The variation in colour of the different horizons serves as one of the factors that leads to the recognition of different soil types and genetic groups. Sometimes the colour of soil in one and the same horizon is not uniform. It may be mottled or variegated. A soil that is moist is usually more dark in colour than when it is dry. As moisture evaporates, the colour becomes lighter in shade. Soil colour varies considerably. There are a number of recognised soil colours. Some of the more important soil colours are black, red, yellow, brown, grey and white. As a result of varying combinations, a number of intermediate shades are obtained. The soil colour is due to the colour of the predominant soil particles. It is usually the weathering complex, both inorganic and organic, that imparts colour to the soil mass.

The black colour of a number of soils is mainly due to the accumulation of humus or decaying organic matter. The presence of humified organic matter is mainly responsible for the black colour of chernozems, rendzinas and other allied soils. Finely divided magnetite and oxides of manganese and titanium, if present in sufficient quantities, also impart a black colour. The presence of these substances has been shown to be partly responsible for the colour of the black cotton or **regur** soils of India. In arid and semi-arid regions there are, at times, patches of black soil known as black alkali. These black patches are due to the accumulation of certain salts like sodium carbonate in the soil which, in combination with humus, give rise to a black coloured soil. The black alkali soils are usually infertile because of the presence of sodium carbonte and other harmful salts.

The colour of the red soils is mainly due to the presence of iron oxide in the form of ferric oxide, Fe_2O_3. Red soils are usually found in tropical countries as high temperature seems to be necessary for their development. The soils of the most tropical regions e.g. laterites, possess red and orange colours which are due to the presence of various hydrated iron oxides.

Yellow soils also owe their colour to iron oxide. The iron oxide in these soils is more hydrated than in the red soils. The following statement shows how the colour of iron oxide varies with its degree of hydration :

Haematite	Fe_2O_3	Red, reddish black
Turgite	$2 Fe_2O_3.H_2O$	Red to reddish brown
Goethite	$Fe_2O_3.H_2O$	Yellow, brown, brownish black
Limonite	$2 Fe_2O_3.3H_2O$	Yellow, brown
Xanthosiderite	$Fe_2O_3.2H_2O$	Golden yellow, brown
Limnite	$Fe_2O_3.3 H_2O$	Yellow

It will be noticed that the more hydrated the oxide, the more yellow is its colour.

The colour of the grey soils is due to the removal of bases like iron from the soil mass by leaching as in the A horizon of a podsol soil. Grey soils are usually formed in humid regions. The soils of marshes and other low lying places where anaerobic conditions prevail are also grey in colour.

White colour usually indicates a sand or sandy soil. A high content or silica silicic acid or calcium carbonate also imparts a white or whitish colour to the soil. In arid regions the presence of salts like sodium chloride and sodium sulphate in the form of an incrustation also gives rise to whitish soils.

Some soils have variegated colours brought about mainly by the alternate oxidation and reduction of iron and manganese compounds and their hydrated products. During oxidation these compounds acquire a red, brown or black colour. During reduction when they are changed to the ferrous and manganous state they acquire a yellow, blue or green colour. This is what happens in soils that are submerged in water for a certain period when reducing conditions prevail, and are again exposed to oxidative processes when the water recedes. This imparts a variegated colour effect to the lower layers of soil that are periodically submerged in water and thus alternately exposed to reducing and oxidising conditions.

The nature of soil colour has a very marked effect on soil temperature. In general dark coloured soils absorb more heat than light coloured soils when they are dry. In moist soils, however, this relationship does not hold good as evaporation of moisture plays a greater part in controlling soil temperature.

Colour thus serves as an indicator of the geological and pedological origin of the soil. It gives a rough idea of its humus content, the degree of leaching it has undergone, the accumulation of certain substances at various levels in the profile and the state of oxidation and reduction to which it has been exposed during its formation and development.

Soil texture

Texture denotes the size of the individual soil particle. Very often the way in which the particles of various sizes have distributed themselves in a profile leads to the formation of definite horizons, each containing particles of a particular size. It results in the development of a texture profile, wherein the various horizons are differentiated from one another by the relative amounts of coarse and the fine particles they contain. The mechanical removal of finer particles from the surface layer tends to make the horizon of eluviation more coarse. The texture becomes more and more heavy with depth, and it reaches maximum heaviness in the horizon of illuviation. This is more clearly seen in soils formed **in situ.**

Soil structure

All the soil particles do not exist in the soil as individual grains. A large majority of them are grouped together to form compound particles known as aggregates. The manner in which the individual grains and aggregates are arranged in the soil mass is known as structure. Soil structure is one of the prominent morphological features which helps to differentiate one soil type from another. Every soil type possesses a structure characteristic of itself developed under a certain set of climatic and other environmental conditions. For instance, in chernozem soils, the upper horizon has usually a pulverulent to granular structure and the lower horizon has a nutty structure. In a solonetz soil the upper layer is structureless and the lower layer has a characteristic columnar structure. The upper horizon of a podsol soil has a pulverulent structure while the lower horizon has a platy structure.

One of the best ways of ascertaining the structure of a soil under field conditions is to throw up a spadeful of soil and let it fall on the ground and break into fragments or structural units. The breaking of the soil mass into fragments resembles very much the splitting of crystals along lines of cleavage or fracture. The large aggregates, when broken, split up into small aggregates which depict very clearly the state of aggregation of individual crumbs.

In a profile, the surface layer or the A horizon is usually structureless or has a feebly developed structure. On going down into the lower layers the structure becomes more pronounced till we came to the B horizon which possesses a very definite structure.

Soil constitution

Constitution indicates the degree of compactness or looseness to which the soil material is built during the process of soil development. It gives an idea of the resistance that a soil offers to the penetration of foreign materials. Compactness may have been brought about either by the cementation effect between the particles themselves or by the infiltration and deposition of camenting materials like silica, lime, iron and aluminum hydroxides, etc. In some cases the constitution is so compact that it offers considerable resistance to the penetration of foreign material like plant roots, water and even implements. This happens in cases where the infiltrating material is deposited on clay particles which themselves possess properties of very high cohesion and adhesion.

On the other hand, the constitution may be loose and porous. In such cases, the soil mass is perforated with pores of varying sizes. Loess and laterite are two outstanding examples of soils having a porous constitution, the form being finely porous and the latter cellular or having small cavities. Sometimes the burrows and channels made by rodents are also responsible imparting a porous constitution. The cultivation implements that are drawn through the soil help to make the surface soil more porous than the sub-soil. Usually horizon A is more loose or porous than horizon B.

Constitution is an important morphological feature of the soil which are very well ascertained by feeling the resistance that a soil offers when pointed instrument is thrust into it. Depending upon the degree of resistance differed to the passage of the instrument the various horizons or horizons can be thus differentiated.

New growth

Sometimes certain compounds, through chemical or physico-chemical reactions, accumulate in the soil mass. They are known as new growths or new formations. They are recognised from their colour, form and shape. The white efflorescence of salts in the case of saline soils is usually formed on the surface of the soil. When the efflorescence is thick it forms a crust. Lime nodules usually occur at lower depths in chernozem and black cotton soils. Gypsum occurs at various depths in many soil types. Concretions and deposits of the compounds of iron, aluminium, manganese, etc., occur in a great variety of colours and forms. Some new formations are encountered in the form of streaks and patches. Veins are formed as a result of the filling in of the passage ways of insects, burrows of rodents and channels left by plant roots, with material washed from the upper horizon.

Inclusions

Remains of plant and animal origin like pertified wood, bones, shells, etc., are sometimes met with in soils. They are known as inclusions. They get entrapped during the process of soil formation, though they themselves do not take part in this process. They throw light on the history of the soil.

The **soils** occurring **Odisha** can be grouped broadly into 8 categories. These are :

1. **Red loam and red sandy soils** (Haplustalfs, Rhodustalfs, Ustothrents (Old Alfisols).
2. **Laterite and lateritic soils** (Plinthustalfs, Haplustults, Ochra qualfs) (Old ultisols and oxisols).
3. **Red and Yellow soils** (Haplustalfs, Paleustalfs, Ustochrepts) (Old ultisols).
4. **Mixed red and Black soils** (Alfisols and vertic associations, intergrades and vertisols (Old-association of ultisols and vertisols).
5. **Black soils** (Chromusterts, Pellusterts, Ustochrepts)
6. **Brown forest soils** (Haplustults, Ustochrepts) (Old-Humults).
7. **Deltaic alluvial soils** (Haplaquepts, Fluvaquents, Haplaquepts) (Old Entisols).
8. **Coastal saline and alluvial soils** (Halaquepts, Fluvaquents, Selic phase ustipsamments) (Old-Haplaquents, Ustipsammuts).

(The terms within the bracket refer to approximate taxonomic units. The term after the bracket gives the old equivalents).

The acid soils (13 mha) constitute about 80% of the state's geographical area. More than 85% of the soils of Mayurbhanj, 90% of Keonjhar and more than 60% soils in the districts of Sambalpur, Sundargarh, Phulbani, and Dhenkanal are acidic. Baleswar (including Bhadrak) has about 37% of the area-acidic. Some black soils (Vertisols, regur) occur in the districts of Kalahandi, Bolangir, and in patches in districts of Angul, Koraput, Khurda (Balugaon area). Red yellow soils with pH ranging from 4.7 to 5.9 are found in Sundargarh. Brown forest soils are seen in Phulbani district. Alluvial soils are found in river banks and in the deltas in the coastal districts. Saline soils are confined to a narrow belt along the sea coast. Some mixed red and black soils are encountered in the border areas of Sambalpur, Bolangir and Phulbani (Fig. 6).

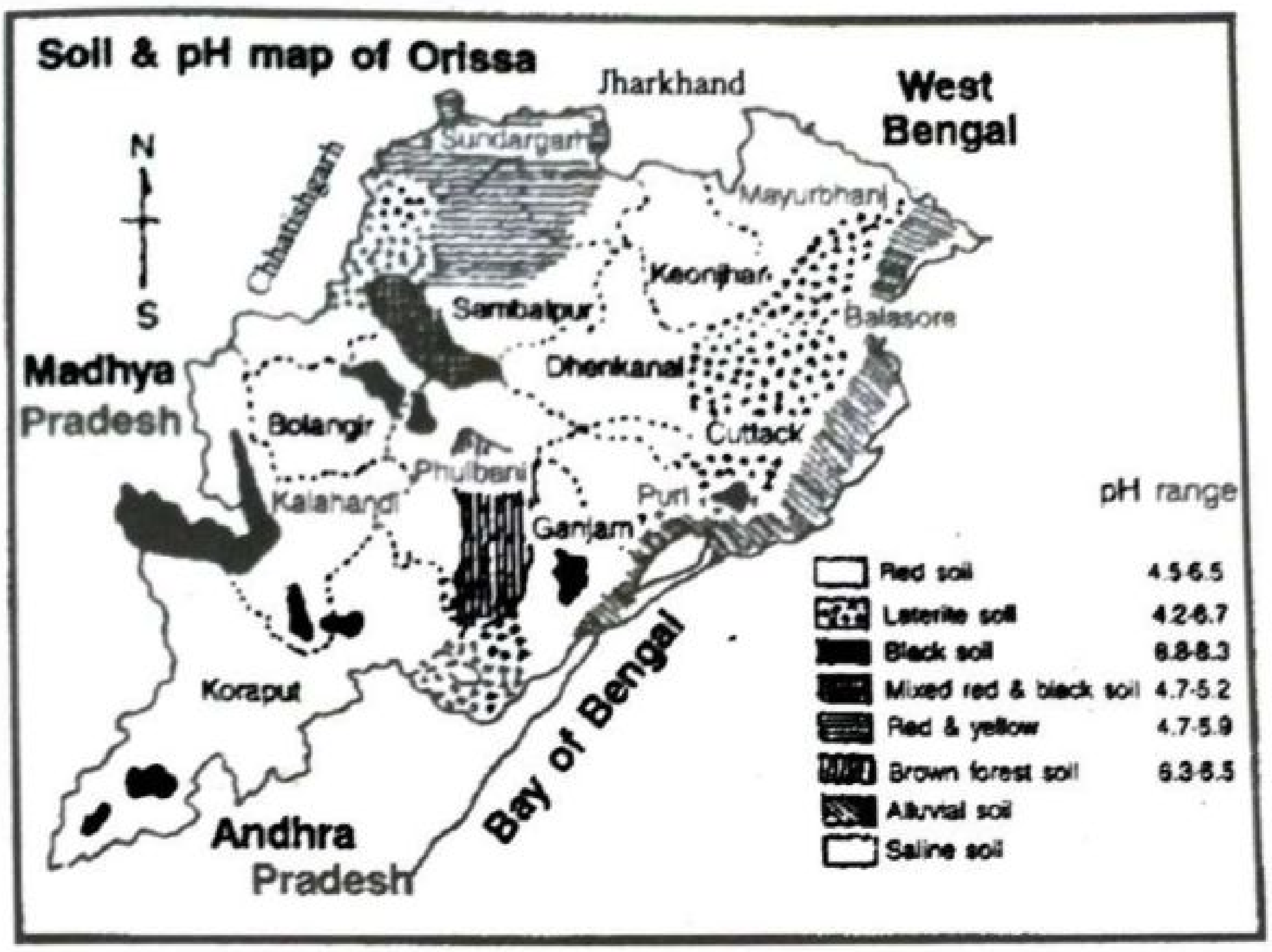
Soil & pH map of Orissa
N
S
Jharkhand
West Bengal
Chhattishgarh
Sundargarh
Mayurbhanj
Keonjhar
Sambalpur
Balasore
Madhya Pradesh
Dhenkanal
Bolangir
Cuttack
Phulbani
Kalahandi
Puri
Ganjam
Koraput
Andhra Pradesh
Bay of Bengal
pH range
Red soil 4.5-6.5
Laterite soil 4.2-6.7
Black soil 6.8-8.3
Mixed red & black soil 4.7-5.2
Red & yellow 4.7-5.9
Brown forest soil 6.3-6.5
Alluvial soil
Saline soil

Fig.-6 *Types of soils in Odisha*

In the acid soil regions of Odisha, pH varies from 4.5 to 5.9 (red soil, laterite soil, mixed red and laterite soil, red and yellow soil). The black soils have pH 6.8 to 7.8; in alluvial soils the reaction is slightly acidic to neutral. In saline soils the pH ranges from 7.8 to 8.5 during the hot months but may remain acidic in rainy season after the salts are washed away. Salinity builds up after December till May. In brown forest soils pH varies from 6.5 to 6.8. Some characteristics are evident from the profiles presented.

From the point of view of the study of vegetation cover, soils occupy a place of basic importance. Soils are the top covering of the earth's surface and have been formed by the wear and tear of rocks. It also contains vegetable and animal materials. The importance of the soils lies in their fertility consisting of organic and inorganic elements. The presence of humus in a soil leads to the growth of the micro-organism, so pH value is important for the development of plants. It conserves moisture in the soil and prevents leaching.

Soil solution behaves in the same general way. It is, however, much more complex as it contains a number of other ions in addition to hydrogen and hydroxyl ions. The presence of other ions tends to modify the reaction to a certain extent as explained later. Moreover, because of the presence of soil particles, the distribution of ions in the solution is not uniform. They are more concentrated close to the surface of colloidal particles than in the rest of the soil solution. Depending upon the preponderance of hydrogen or hydroxyl ions soils may be acid, alkaline or neutral in reaction. Those having pH less than 7.0 are acid soils, and those greater 7.0 are alkaline. Soils, however, vary considerably in the intensity of their acidity or alkalinity. For practical purposes, soils having pH ranging from 6.5 to 7.5 are considered neutral as they very slight acidity or alkalinity indicated by this range is of no consequence as far as crop growth is concerned. Soils having pH between 6.5 and 6.0 are considered slightly acid, those between 6.0 and 5.0 are considered moderately acid, those between 5.0 and 4.0 strongly acid, while those having pH less than 4.0 are extremely acid. There are very few cases of soils having pH less than 3.0. Such soils are usually barren as no plant is able to tolerate such a right acidity.

Similarly, soils having pH between 7.5 and 8.0 are considered slightly alkaline. Those between 8.0 and 9.0 are moderately alkaline, those between 9.0 and 10.0 strongly alkaline, while those having pH greater than 10.0 are extremely alkaline. Crop growth is practically impossible in such soils.

Soil reaction is of great importance as it influences crop growth both directly and indirectly. Higher plants as well as microorganisms respond markedly to their environment of which soil reaction is an important contributory factor. Most plants do well in neutral soils. Many of them fail to grow properly if the reaction becomes very acidic or alkaline. On the other hand, there are some species of plants that require an acid or alkaline reaction for their best performance. The availability of many plant nutrients depends to a large extent on the prevailing soil reaction. Iron, manganese, zinc, copper, etc., are available more in acid than in alkaline soils. Phosphorus becomes less available or completely unavailable depending upon the reaction of the soil. We shall discuss the effect of pH on different plant nutrients and their availability in greater detail a little later.

The reaction of the soil also exerts an important influence on soil structure. As explained later, soil pH is governed by the nature of caption held by colloidal particles. The caption, in turn, control the aggregation of colloidal clay, and hence soil reaction indirectly influences soil structure.

Soil reaction also influences the activity of microorganisms which in turn influence plant growth and crop production. Most microorganisms are very active in neutral or slightly alkaline soils. The decomposition of organic matter and the release of nutrients like nitrogen, phosphorus, sulphur, etc., in available form depend, therefore, on soil reaction. The nitrogen fixing bacteria, both symbiotic and non-symbiotic, require neutral or slightly alkaline soils for their best activity.

Soil reaction influences the need for fertilisers. The availability of phosphorus in superphosphate is much less in acid soils, and thus a higher application of the fertiliser is needed. In calcareous and alkaline soils, the availability of potassium, phosphorus, iron and many minor elements is reduced, and hence the application of fertilisers carrying these elements is necessary for such soils.

Soil reaction affects the quality of crops also. The quality of tobacco grown in more acid conditions is greatly impaired. It influences the incidence of plant diseases especially those that are soil-borne. Acid soils favours the development of diseases like the Panama disease of banana and others. On the other hand, a certain degree of soil acidity helps to keep certain diseases, e.g., potato scab, in control. A high pH favours the incidence of black rot disease in tobacco and the damping off disease of some plant species. Calcareous alkaline soils are responsible for inducing chlorosis in a number of crops. Soil reaction, therefore, plays a very important role in governing the relation between soil condition and crop production.

Measurement

Several techniques have been proposed for measuring soil pH. There are two principal methods : (1) electrometric, and (2) colorimetric. There are several variation of the electrometric method known according to the type electrode used : (a) quinhydrone method, (b) hydrogen electrode method, (c) glass electrode method, and (d) antimony electrode method.

In the quinhydrone method, the oxidation-reduction potential between quinone and hydroquinone which depends on the activity of H ions is measured under standard conditions of temperature, soil water ratio etc. The method is useful for soils that have pH less than 8.5 only. Even then it fails to give accurate readings if the soil contains substances like manganese that disturb the oxidation-reduction potential. The presence of soluble salts also introduces errors. These disturbances and limitations have restricted the use of this method.

The hydrogen electrode method measures the EMF of the equilibrium between hydrogen dispersed in platinum black and H ions in solution against the EMF of a standard cell. It gives very accurate results but requires a number of precautions to be taken and corrections to be made which rule it out for every day use.

The glass electrode method is the most suitable for measuring the pH of soils as well as biological fluids. It measures the potential between the glass electrode membrane and the solution which is closely reated to its pH.

In the colorimetric method, certain dyes are used which change colour with variations in H ion activity of solutions. This method is good enough for field work where quick results are necessary. It is open to several errors introduced by a number of factors and hence the results obtained are only approximate.

FACTORS CONTROLLING SOIL REACTION

A number of factors influence soil reaction. In addition to the nature and concentration of soil solution, the other important factor that controls soil reaction is the type of colloidal material and the nature of exchangeable cations it holds. The nature and concentration of soil solution is in turn controlled by the nature of salts, the amount of water present in the soil and the CO_2 pressure in soil air. Parent material, climate and cultural practices also influence the nature of soil reaction. On account of the various factors that influence soil reaction, soil pH does not have the same meaning as the pH of simple aqueous solutions for the reasons explained in the following paragraphs. In the case of simple solution, its pH represents the actual activity of H ions that are uniformly distributed in it. In the case of a soil, the pH of the soil solution is very different from that of its suspension which again differs from that of the soil paste. Thus the soil water ratio and the separation of soil solution from the soil mass have a profound effect on soil reaction.

Nature of colloids

The colloidal particles of the soil influences soil reaction to a very great extent. In the case of inorganic colloids, the dissociation of clay particles varies with the type of clay mineral. Montmorillonitic clays saturated with hydrogen dissociate to a greater extent than similarly saturated kaolinitic clays. The former are, therefore, more acidic and give a lower pH value at the same percentage of neutralisation with a particular base than the latter. The organic colloids are intermediate in this respect but behave more like montmorillonite.

On the other environmental factors, soil acidity and the amount of organic matter present in or added to the soil influence the fungal population considerably. Though they grow equally well in acid, neutral on alkaline media fungi are able to withstand acidity better than other organisms especially bacteria. Hence fungi are more abundant in acid soils than in neutral or alkaline soils. They show considerable difference even in their tolerance to acidity. The optimum reaction lies between pH 4.5 and 5.5. When the acidity is greater than pH 4.0, there is a great fall in their number. There are some fungi that are able to grow in culture at pH as low as 1.5 and numerous others at pH as high as 9.0.

Soils rich in organic matter contain a greater number of fungi than those poor in this constituent. As organic matter serves as a source of food nutrients the addition of organic matter leads to an immediate increase in fungi population so also acid fertilizers increase the number of fungi in the soil. Application of lime on the other hand decreases their number. Organic matter influences not only their number but also the type of fungi. Depending upon the nature of organic matter and the stage of decomposition, the nature of the fungal flora changes as explained later.

All fungi, with the exception of a few aquatic ones, are aerobic organisms. They require a plentiful supply of free oxygen for their development. Hence fungi are usually absent or their number considerably reduced in waterlogged and swampy soils. Like all other living things they require adequate moisture in the soil. If the moisture content increases beyond, or decreases below, the optimum value, the fungal population suffers and its number goes down.

Seasonal variations that induce changes in temperature, soil moisture content, supply of organic matter and other environmental factors also influence the fungal population. The number of fungi is usually low in summer and high in monsoon. In temperature regions, the number is high in spring and autumn and low in summer and winter.

Broadly, the soil of Odisha may be classified as transported and residual soil on the basis of the mode of formation. The transported soil is an admixture of eroded materials and is heterogeneous in character. The residual soils are mainly worn out by different agents of erosion. They preserve the character of bedrocks.

8

NATURAL VEGETATION AND FOREST RESOURCES

- **Moist Tropical Forests**
- **Dry Tropical Forests**
- **Montane Sub-Tropical Forests**
- **Forest Plantations**
- **Economic Plantations**

NATURAL VEGETATION

The type of vegetation of a place depends on its rainfall, interference by man and soil. The vegetation types met with in different districts of Odisha have been studied by Heines (1925). Rao and Panigrahi (1961). Panigrahi at all (1964). Champion and Seth (1968) in their comprehensive studies on the forest types of India, recognise the following five main types, within which, however, they include a number of subtypes on the basis of local edaphic, physiognomic and biotic factors. Prof. B. N. Sinha made general classification of Natural vegetation of Odisha into four types as follows :

1. The Northern Tropical Semi-evergreen Region.
2. The Northern Tropical moist Deciduous Region.
3. The Northern Tropical Dry Deciduous Region, and
4. The Coastal Forests.

However, the same serial numbers as coded by Champion and Seth (1968 : 48 – 56) is followed in a summarised form.

I. MOIST TROPICAL FORESTS :

Group 2.	Tropical semi-evergreen Forests.
Sub-group 2B	Northern Tropical semi-evergreen Forests.
C_3	Odisha Semi-evergreen Forests

General edaphic and seral types of semi-evergreen Forests.

E_1	Cane brakes
E_{13}	Moist bamboo-brake
2.S1.	Secondary Moist Bamboo brakes.

Group 3.	Tropical Moist Deciduous Forests.
Sub-group 3B	South India moist deciduous forests.
C_1	Slightly moist teak forest
C_2	Southern moist mixed deciduous forest
2S1	Southern secondary moist mixed deciduous forest.
Sub-group 3C	North India moist deciduous forests
C1(d)	Very moist peninsular (Coastal) Sal forests.
E	Terminalia tomentosa forest.
DS1.	Moist Sal Savannah
	General edaphic and seral types of moist deciduous forest
$1S_1$	Low alluvial Savannah Woodland (Bombax) (Albizzia)
Group 4.	Littoral and Swamp Forest
Sub-group 4A	Littoral forest
L1	Littoral forest
Sub-group 4B	Tidal Swamp forest
T S (1-4)	Tidal Swamp forest

Mangrove scrub, Mangrove forest, Salt-water mixed forests and Brackish wa mixed forests.

TS/E_1	Palm Swamp
Sub-group 4C	Tropical fresh water swamp forests.
FS_2	Sub-montane hill-valley swamp forest.
Sub-group 4E	Tropical Riparian fringing forests.
$R.S_1$	Riparian Fringing forests

II. DRY TROPICAL FORESTS :

Group 5	Tropical Dry Deciduous Forests
Sub-group 5A	Southern Tropical Dry Deciduous Forests
C_1b.	Dry teak forests
Sub-group 5B	Northern tropical dry deciduous forests
C1c.	Dry peninsular Sal forests.
C_2	Northern dry mixed deciduous forests.

Degradation stages of tropical dry deciduous forests.

DS1.	Dry deciduous scrub

DS 2.	Dry Savannah forest
DS 4.	Dry grassland

General edaphic types of dry deciduous forests

E2.	Boswellia forest
E4.	Hardwickia forest
E6.	Aegle forest
E7.	Laterite thorn forest
E9.	Dry bamboo-brake

General seral types of dry deciduous forests

1 S1.	Southern dry tropical riverian forest
1 S2.	Khair-Sisso forest
2S1.	Secondary dry deciduous forest

III. MONTANE SUB-TROPICAL FORESTS :

Group 8.	Southern sub-tropical broad leaved hill forest.
Sub-group 8A.	Southern sub-tropical broad leaved hill forests.
C_3	Central-Indian sub-tropical hill forests.

The distribution, characteristic features and chief components of the various vegetational types tabulated above in relations to Odisha is given below :

Tropical Semi-evergreen Forests :

It occurs in the lower hills and valleys at ± 800 m in the Mayurbhanj-Keonjhar, Cuttack-Puri districts running almost parallel to the deltaic coast of the Bay of the Bengal. Within this Semi-evergreen forests, almost tropical evergreen type of vegetation is met within the Atai Reserve on the Gandhamardan range in the Keonjhar district, the forests near Banguru (900 m) on the belt of Meghanad Parbat. Malayagiri Reserve near Pal Lahara and in pockets adjacent to the Barehipani waterfall in the Similipal Reserve Forest in the Mayurbhanj district. The chief components of the semi evergreen type of vegetation are : Artecarpus lakoocha (D), Michella champaca (E), Celtis diandra (D), Bridelia tomentosa (D), Saraca asoca (E), Ficus spp. (E), Mangifera indica (E), Mesus ferrea, Litsea nitida etc. Within the semi-evergreen forests, however, a number of edaphic and seral types are met with, such as Cane brakes, wet bamboo brakes or Moist bamboo brakes. The Cane brakes constitute an impenetrable thorny thicket, sometimes a few fall trees standing above it. The stems of Calamus spp. may be 60m or more long but some species are more or less erect. Northern tropical wet evergreen forests comprising large tall evergreen trees consists of a large number of species, deciduous trees are low.

Tropical Moist Deciduous Forests :

This is also known as MONSOON FOREST or Wet Mixed Deciduous Forest. Th covers the largest portion of the hilly districts of Odisha, barring a small tract in the northernm part of the Mayurbhanj district and parts of Western districts bordering upon Madhya Prade and Chhatisgarh in the west and Andhra Pradesh in the south. A leafless period occurs in th dry season, most generally in March-April, while the underwoods and the shrubs rema evergreen. Toona ciliata, Delbergia Sisoo, Sterculia spp etc. are common deciduous elemen together with Shorea robusta (sal) and Pterocarpus marsupium (bijasal). This type of fore is also known as sal forest due to the undisputed predominance. The sal typically forms th high forest in which it constitutes 60-90 per cent of the top canopy, with a height of abo 40m. The SAL has a semi-evergreen habit with a deciduous period of 5 to 15 days at th beginning of the hot weather. The forests of Kalahandi district are classified under the Mo Peninsular high level.

Sal which extend over hills on laterite trap and crystalline rocks. Shorea robusta associated with Bauhinia spp. Toona ciliata etc. The forests of the Angul Division on the othe hand, are classified as Moist Peninsular low level sal, where sal is associated with Terminal tomentosa. Adina cordifolia etc. Keonjhar, West Debgarh, Bhuban, East of Dhenkanal Bhubaneswar, Nayagarh and Paralakhemundi sectors represent a heterogeneous zone whe sal, the principal species falls short of 50 per cent of the stand and gets mixed with Adin cordifolia, Anogeissus Latifolia (Dhaura) etc. There is also another area in the form of inverted triangle with Sonepur and Athmallik at the base and Phulbani at the apex with simila floristic components. The mountain ravines of Banei represent Humid Mixed Forests almos semi-evergreen in nature, though Sal is common in the drier regions.

Tropical Dry Deciduous Forests :

Some parts of Sambalpur, Bolangir, Kalahandi and Koraput districts represent th southern Tropical Dry Deciduous type of forests, whereas the northern parts of Mayurbha district come under the Northern tropical Dry Deciduous type. The most characteristic tree Anogeissus latifolia with other trees.

Central Indian Subtropical Hill Forests :

This represents the Hill Top Forests found on hill tops over 900 m. up to 1200 m. I Odisha, where the soils are typically shallow on steep slopes. Representatives of the Himalaya genera such as Hypericum, Rubus, Barberis are seen along with Pteridium (Braken). Simila vegetation has also been recorded on the ravines at an altitude of nearly 750 m. upto 1000 m. i the district of Kalahandi, and Meghasani (1165 m), Jamunai (1015 m) in the Mayurbhanj distric Meghanada Parbat in the Keonjhar district, the Gandhamardan Parbat (1000 m) in the borde of Sambalpur-Bolangir district, the Malayagiri (1188 m) in the Dhenkanal district, Chandragir (1270 m) Bhim-raj-Daur and Mahendragiri (1501 m) in Ganjam district and Kalimela (1090 m) in Koraput district among others.

Tidal and the Littoral Swamp Forests :

The tidal swamp forests vary so much over short distances that a general description is rather difficult. This finest forest is found on ground-which is flooded at every high tide with only moderately brakish water and represents an evergreen closed high forest 30m or more in height. (Heritiera (Sterculiaceae) Rhizophora etc). The entire mangroove and associated vegetation can be divided into three stages based on habit and ecological requirement : salt water forest, moderately salt water forests and fresh water forests. There are two successional stages : sand dune progression and saline swamp progression.

The vegetation of the sandy coast gives a totally different picture. The Littoral forests comprises mainly by the tall evergreen species. Cesuarina equisetifolia along with Pongamia pennata. Pandanus tectorious etc. Cocos nucifera (Coconut) is also planted along the moist sites.

FORESTS RESOURCES

Forests play a vital role in maintaining ecological stability. They provide protection against, and reduce impact of natural calamities like droughts, floods and cyclones. Forests are also in important source of livelihood for weaker sections of society in general and tribal in particular. Forestry activities also create substantial wage employment opportunities. Forests also provide a wide variety of products of commercial value such as timber, lac, resins, oil seeds, kendu leaves and medicinal plants. However, forest cover is dwindling at a fast pace. Several factors, including rising population, increasing needs for fuel wood, timber and fodder, and increasing industrialisation and urbanisation have contributed to large scale forest degradation. Deforestation needs to be arrested and measures need to be taken for rapid reforestation in degraded forest areas.

Odisha has a recorded forest area measuring 58136.907 sq. kms. i.e. 37.34% of the State's Geographical area of 1,55,707 sq. kms. As per the "State of Forest Report, 2001" prepared by the Forest Survey of India, the State has only 48,838 sq. kms. of forest cover and 4,364 sq. kms. of tree cover which account for 31.4% and 2.8% of the total geographical area respectively. Of this, 27,972 sq. kms. is Dense forest i.e. with crown density greater than 40% including Mangrooves, and 20,866 sq. ksm. is open forest i.e. with crown density between 10% to 40%, Scrub forest with crown density less than 10% constitutes 5,782 sq. kms.

Forests of the State are unevenly distributed. The coastal districts with higher population density are having comparatively smaller areas of forest. Higher forest coverage is found in the districts of Kandhamal, Sundargarh, Mayurbhanj, Sambalpur, Malkangiri, Gajapati, Deogarh and Keonjhar. The National Forest Policy, 1988 has mandated that 33% of the geographical area should be under forest cover, with 60% coverage in hilly tracts and 20% in plains. Against thi the State has 31.4% forest cover.

The forest sector objective in the Annual Plan 2004-05 and Tenth Plan period is t promote sustainable forest management in the State with a larger goal of supporting the rura livelihoods. Recognising crucial linkages between rural livelihood and conservation of fore resources, the plan specifically focus on conservation and development of forests and optima use of forest resources in a sustainable manner. The immediate goal of forestry in the State is t protect the existing dense forests with their rich bio-diversity and wildlife from degradation an to restore through appropriate treatment their vigour for natural regeneration. The forest policy rules and regulations in force will also be fine-tuned and modified wherever required during the Tenth Plan period to make the policy and institutional environment conducive for Joint Fores Management of degraded forests.

The forestry sector development in the ELEVENTH PLAN, (2007-2012) has adopted an approach combining elements of asset creation, institutional development and social development to promote sustainable forest management practices. The plan will support development of forest resources in the State with focus on :

(i) Conserving, protecting and developing 26.073 sq. kms. of dense forests.

(ii) Regenerating and developing 20.745 sq. kms. of open forests.

(iii) Afforesting and reforesting 11.102 sq. kms. of scrub forests.

(iv) Promoting Eco-tourism and Eco-development in the protected area and

(v) Building capacity of the Forest Department and Village level institutions to take up protection and management of the assigned forests.

FOREST PLANTATIONS

In order to prevent fast depletion of forest resources and to enhance ecological stability, plantation programmes have been undertaken in degraded forests and waste lands under various States and Central Plan schemes. The main objective and strategy of forest planning is to achieve the mandated 33% forest cover in place of the present 31.4% and also to restock the forest in the entire recorded forest area which is 37.3% of the State's geographical area. Action taken for fulfillment of this objective will lead to creation of additional employment opportunities for economically backward groups such as tribals and women.

During 2002-03, forest regeneration activities including Block Plantations and Rehabilitation of Degraded Forests (RDF) Programmes have been carried out over an area of

17,489 hectares. Besides, 297.75 lakh seedlings have been distributed to farmers under Farm Forestry against the target of 298.90 lakh. The Territorial as well as the Afforestation and Social Forestry wing have implemented afforestation works. Bulk of the plantation is carried out in KBK districts under RLTAP. The plantation programmes carried out by different wings of Forest Department from 1998-99 to 2002-03 are summerised in Table – 6 and 7.

TABLE - 6

Achievement under Plantation Programmes by Different Wings of Forest Department

Sl. No.	Activity (Unit)	Name of the Organisation	Achievement during the year				
			1998-99	1999-00	2000-01	2014-15	2015-16
1	2	3	4	5	6	7	8
1	Block Plantation (ha)	Territorial	6,340.80	30,883.96	15,389,96	18,673.42	10,589.00
		SFP	680.50	398.00	2,607.00	2,700.00	800.00
		OFDC	309.25	374.04	134.53	161.50	–
		Total	7,330.55	31,655.64	18,131.49	21,534.92	11,389.00
2	Rehabilitation of Degraded Forests (ha)	Territorial	8,409.17	18,857.36	26,115.00	26,273.86	6,100.00
		SFP	1,251.00	–	5,000.00	4,100.00	–
		OFDC	–	–	–	–	–
		Total	9,660.17	18,857.36	31,115.00	30,373.86	6.100.00
3	Farm Forestry (Seedling) distributed in lakh)	Territorial	325.63	325.63	–	–	60.00
		SFP	3.36	–	327.14	349.57	237.75
		OFDC	–	–	–	–	–
		Total	328.99	325.63	327.14	349.57	297.75
4	Avenue Plantation (Rkm)	Territorial	533.17	43.93	80.04	–	–
		SFP	148.15	97.66	132.00	–	–
		OFDC	34.29	50.24	4.00	4.00	
		Total	715.61	191.83	216.04	4.00	–

Territorial : *Territorial wing of Forest Department.*

SFP : *Social Forestry Project.*

OFDC : *Odisha Forest Development Corporation.*

Source : *Principal Chief Conservator of Forests, Odisha, Bhubaneswar.*
Directorate of Social Forestry, Odisha, Bhubaneswar.
Odisha Forest Development Corporation, Bhubaneswar.

TABLE - 7

Classification of Forest area by Legal status in Odisha

(Area in Sq. Km

Sl. No.	Year / 2016 District	Reserve Forest	Demarcated protected Forest (DPF)	Un-demarcated protected Forest (UPDF)	Un-classified forest	Other Forest under the control of Revenue Deptt.	Total Go Forest
1	2	3	4	5	6	7	8
	2016						
1	Angul	1760.76	273.21	11.99	1.15	669.71	2716.82
2	Balasore	202.69	21.54	–	0.19	107.79	332.21
3	Bargarh	583.52	451.19	–	0.13	181.29	1216.13
4	Bhadrak	–	3.96	32.98	0.01	60.12	97.07
5	Bolangir	1105.68	3.63	–	0.14	434.40	1543.85
6	Boudh	983.33	43.48	–	1.02	249.34	1277.17
7	Cuttack	522.39	101.96	–	0.45	163.65	787.90
8	Deogarh	578.40	243.86	–	0.04	737.92	1560.22
9	Dhenkanal	1141.02	13.78	–	0.04	582.78	1737.62
10	Gajapati	416.89	108.15	1149.41	0.13	794.40	2468.98
11	Ganjam	1485.69	143.54	1167.39	0.86	352.45	3149.90
12	Jagatsinghpur	1.23	4.77	83.06	0.02	43.84	132.92
13	Jajpur	6.35	299.32	–	0.01	419.50	725.27
14	Jharsuguda	35.53	109.97	–	0.04	56.90	202.44
15	Kalahandi	1449.03	488.51	313.37	0.54	286.56	2538.01
16	Kandhamal	2010.06	1783.30	–	2.00	1914.47	5709.83
17	Kendrapara	14.49	127.57	62.32	4.50	39.17	248.05
18	Keonjhar	1834.09	273.64	220.79	0.26	768.40	3097.18
19	Khurda	298.81	209.87	–	0.68	109.31	618.67
20	Koraput	478.86	984.58	–	0.68	415.41	1879.53
21	Malkangiri	352.44	940.61	661.92	0.30	1400.61	3355.88
22	Mayurbhanj	3330.14	245.06	–	2.20	814.73	4392.13
23	Nabarangpur	535.34	685.77	–	0.07	1241.55	2462.73
24	Nayagarh	1301.99	188.03	135.58	0.25	455.12	2080.97
25	Nuapara	–	1504.00	–	0.44	345.25	1849.69
26	Puri	15.66	85.88	–	0.51	35.05	137.10
27	Rayagada	771.62	1147.19	–	0.96	892.56	2812.33
28	Sambalpur	2151.71	363.01	–	1.18	1115.87	3631.77
29	Subarnapur	309.52	–	–	0.03	106.23	415.78
30	Sundargarh	2651.88	837.06	–	1.72	1466.87	4957.53

Source : Principal, Chief Conservator of Forests, Odisha, Bhubaneswar.

ECONOMIC PLANTATIONS

The value of the growing stock of our forests is substantially lower in comparison with the other States. This situation can be improved by raising plantations of economically important species like Teak, Sissoo, Rose wood and Red Sanders etc. On suitable sites on a sustained basis. This will ensure substantially higher production of valuable timber in future. About 4,000-5,000 hectares of suitable degraded barren land in the non-KBK districts will be treated under this scheme every year and about 12,000 hectares of Teak plantations will be raised. During 2015-16, Teak seedlings available in the Department have been utilised for raising 2984.5 hectares plantation in non KBK districts.

With financial assistance from Government of India, casurina plantation over 7,735 hect. is under implementation under the Central Plan IAEP scheme for restoring the Coastal Shelter Belt Plantation in the districts of Puri, Ganjam, Jagatsinghpur, Kendrapara, Bhadrak and Balasore. An area of 4,000 hect. has been covered in 2015-16.

Area-Oriented Fuel Wood and Fodder Project Scheme :

The Area-Oriented Fuel and Fodder Plantation Scheme (AOFFP) is a Centrally Sponsored Plan scheme with a funding pattern of 50 : 50 between the Centre and the State. The main objective of the scheme is to augment production of fuel wood and fodder species through regeneration of degraded forests and adjoining lands by associating the local people in planning, implementation and management under JFM.

Kendu Leaf :

Kendu leaf is one of the most important minor forest products and is used for manufacturing bidis. Plucking of Kendu leaf is highly labour intensive activity and it creates employment opportunity for the rural poor in most interior areas. During 2002-03 the Kendu Leaf Organisation has opened 7,820 phadis in different districts of the State for purchase of Kendu leaf and 975 Kendu leaf Central Godowns have been developed for storage of processed and phal K.L.bags.

During 2015-16, about 4.60 lakh qtls. of Kendu leaf were produced and 9.40 lakh pluckers (to whom pluckers card issued) were benefited. Besides, 65 lakh mandays of wage employment were generated in the work of Bush cutting, Phadi repair, seasonal workers, drying and storage, processing and binding of Kendu leaf etc. During 2015-16, 3,87 lakh quintals (both processed and phal) were produced. The price offered for Kendu leaf has been revised since last year with 20 paisa per 20 leaves with one paisa incentive for each 20 leaves. 2,547 MT, of food commodities under World Food Programme have been issued as an incentive to the binding labourers during the year. The revenue from Kendu leaf trade has increased from Rs. 69.00 crore during 2014-15 to Rs. 75.00 crore during 2015-16 exhibiting an increase of about 8.7%. The Kendu Leaf Wing is responsible for production and processing of Kendu leaves and Odisha Forest Development Corporation (OFDC) is responsible for marketing of Kendu leaf products. Out of the total stock of 4.6 lakh qtls. produced in the crop year 2014, by October, 2015, 4.58 lakh qtls. (99.5%) have been sold by OFDÇ Ltd. fetching an average price of Rs. 4,182/- per qtl.

During 2015-16 (2014 crop year), it has been targeted to increase the number of Phadies to 7,915 by opening 95 new Phadies under Jeypore Kendu Leaf Division and the production of Kendu leaf to the tune of 4.85 lakh quintals.

TABLE - 8

Revenue Receipts from Forest Products

(Rs. in crore)

Sl. No.	Item	1998-99	1999-00	2000-01	2014-15	2015-16
1	2	3	4	5	6	7
1	Timber and firewood	6.47	5.21	14.23	9.36	9.15
2	Bamboo	8.52	5.50	5.11	2.03	0.07
3	Kendu leaf	63.50	74.50	55.00	69.00	75.00
4	Minor forest produce	–	–	–	1.33	0.62
5	Others	8.32	10.18	9.91	6.09	12.08
	Total	**86.81**	**95.39**	**84.25**	**87.81**	**96.92**

TABLE -9

Details of Revenue from Forestry in Odisha

(Amount in '000 Rs.)

Sl.	Items	2002-03	2003-04	2004-05	2014-15	2015-16
1	2	3	4	5	6	7
1	Major Forest Products					
a)	Timber	85491	29031	79424	65057	97298
b)	Fire wood	5995	556	2693	1415	1061
2	Minor Forest Products					
a)	Kendu leaf	750000	310000	242500	401466	1020982
b)	Bamboo	699	3590	808	2	1
c)	Grass and other minor products	6174	10126	1554	447	949
3	Drift & waif wood and confiscated forest product	5921	7365	7293	10413	5761
4	Commutation fees	325	639	823	782	591
5	Receipt from Nandankanan	8626	8727	10944	11554	13458
6	Miscellaneous	105983	128022	477952	23532	19199
	Total	969214	498056	823991	514668	1159300
	Deduct refunds (–)	–	–	35	–	–
	Total Revenue	**969214**	**498056**	**823956**	**514668**	**1159300**

***Sources** : Principal, Chief Conservator of Forests, Odisha, Bhubaneswar.*

Forest resources of Odisha, once exceeded optimum requirement of the state but their maldistribution poses a serious problem. The fertile coastal plains with dense population lack forest cover. Then again, inaccessibility of the forests from the consumption centres and the bulky nature of their products need cheap haulage. Odisha is very much lacking in this respect. Its rivers with their beds dry in summer are unsuitable as a cheap means of transport. A well-developed road and rail network is also lacking. The presence of a large tribal population practising shifting cultivation (Podu chasa) on an extensive scale endangers direct loss of valuable forest cover. Overall, forest coverage figures are highly conflicting and controversial.

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9

WILD LIFE

- **Wildlife Sanctuaries**
- **National Parks**
- **Wildlife Population in the State**

Odisha with its diversified topography and climate has been the abode of a variety of wildlife species. But due to inadequate protection measures and dwindling forest cover, there has been a rapid decline in the wildlife population in the State. In order to protect and preserve wild life, 18 Wildlife Sanctuaries and 2 National Parks have been constituted. The committee set up by the Government of India for 'rationalization of boundaries' of National Parks and Sanctuaries have submitted its report regarding the steps to be taken in respect of villages situated within the boundary of the Sanctuaries declared under Section-18 of the Wildlife (Protection) Act, 1972. The total area of Sanctuaries/National Parks (excluding the Gahirmatha marine sanctuary in the sea) is 4.2% of the geographical area of the State and 11.37% of the recorded forest area. The Rationalisation Committee recommends that in order to check any diminishing coverage of area under PA, where villages are required to be excluded as per recommendation of the Collector, new areas have to be added to the existing sanctuary.

Eighty four species of reptiles, 446 species of birds and 65 species of mammals have been identified in the protected areas. The Wild life Status Survey and Census is periodically carried out by forest personnel with active participation of various non-official enumerators. Table 10 gives names of some important species and their number as per Status Survey and Census reports for different years, besides the captive stock at Nandankanan Zoological Park.

Three Elephant Reserves (ERs) namely Mayurbhanj ER, Mahanadi EF and Sambalpur ER were notified in the State in the years 2001 and 2002. These Reserves are meant to define the prime elephant habitats and to launch various management interventions of conservation of elephant. The extent of notified and proposed forest blocks in these three reserves is 4,129 sq. kms., and the geographical area covered by these three reserves is 8509 sq. kms. Constitution of two more elephant reserves, i.e., Brahmani Baitarani ER and south Odisha ER as well as expansion of the Mahanadi and Sambalpur elephant reserves for providing better habitat conditions to elephants and for reducing the problems of elephant depredation are being contemplated.

TABLE – 10

Wildlife Population in the State

Name of species	Number	Census Year	Remarks
Tiger	192	2004-05	In the wild (entire State)
Leopard	487	-do-	-do-
Elephant	1862	Till May, 2007	-do-
Water Birds	19.88 lakh	2014-15	Chilika lake, Bagagahan Bhitarkanika Sanctuary & Hirakud
Olive Ridley Sea Turtles	2.96 lakh	2014-15	Gahiramatha and Rushikulya
Irrawady Dolphin	306 lakh	2014-15	Chilka lake
Black Buck	1201 lakh	2014-15	Balipadar – Bhetnoi & Buguda area of Ganjam district
Mugger	268 lakh	2014-15	Satakosia & Similipal Tiger Reserve
Salt Water Crocodile	1590 lakh	2014-15	In Bhitarkanika river mouth

***Source :** Chief Warden, Wildlife, Odisha, Bhubaneswar.*

The State Government has received approval of government of India for declaration of 2nd Tiger Reserves in the state comprising of Sunabeda sanctuary and adjoining forest areas to its south in Nuapada district.

As per Tiger Census conducted in 5th – 10th January, 2004, there were 192 tigers and 487 leopards in the State as against 173 tigers and 457 leopards counted in 2002 Census. Out of 192 tigers and 487 leopards, 101 tigers and 127 leopards were found in Similipal area.

As per the elephant survey conducted in April, 2004 there were about 1841 elephants in the state, and have increased to 1862 in May, 2007. Mayurbhanj Elephant Reserve and Mahanadi Elephant Reserve together constitute about 60% of the elephants found in the state. The comprehensive plan for management of elephants in the state during 2006-07 the Eleventh Five Year Plan has been prepared.

The Bhitarkanika Wild Life Sanctuary and the Bhitarkanika National Park are spread over an area of 672 sq. km. and 145 sq. km. respectively. The Gahirmatha Sanctuary covering an area of 1,435 sq. km. the largest nesting ground for Olive Ridley sea turtles in the world. During 2014-15, 1.96 lakh Olive Ridley sea turtles came to Gahirmatha beach and Rushikulya river mouth for nesting and laying eggs. The number of salt water crocodiles which was 67 during the year 1998 in Bhitarkanika river mouth has increased to 1590 during the census year 2014-15 (Table-10).

The Chilka (Nalabana) Wild Life Sanctuary was started in December, 1987 over an area of 15.58 sq. km. which is not only an ideal habitat for migratory birds but also for the endangered Irrawady Dolphin. It attracts migratory birds from far off countries during Winter

Season every year. There was a good congregation of migratory water fowl in the Chilika lake during this year due to excellent protection afforded to bird species in the lake. Steps are taken to safeguard the visiting birds from any infection due to avian flue. As per the Census conducted in January, 2014-15, 10.80 lakh birds belonging to 107 species were counted.

State Government has taken measures for wildlife protection in the state. During 2006-07, 104 incidents of poaching, deliberate electrocution, poisoning and trapping have been reported out of which 78 cases have been detected and cases have been filed against 181 accused, as against 193 incidents, 72 detected cases and judicial cases filed against 232 accused people during 2014-15.

During 2014-15, about 92 human death and 141 injuries were recorded due to wildlife attacks. Besides, crop damage over an area of 4,835.6 ha. land by elephants have also been recorded during the year and an amount of Rs. 179.07 lakh compensation has been paid for the purpose.

Nandankanan Zoological Park

Amidst lush green forests along the banks of Kanjia lake lies Nandankanan, a beautiful zoological park that got its name from "Nandan Van" meaning the "Garden of Gods". The zoological park is set in a beautiful natural setting and is one of the finest parks in the country. Unlike conventional zoos, this zoo has got a very good natural habitat and the park is unique of its kind. The zoological park together with the lake and Botanical Garden has been declared as Nandankanan wild life sanctuary. The Nandankanan zoological park was established in December, 1960 while it was declared as wildlife sanctuary in August, 1979. The area of Nandankanan zoological park is 3.62 sq. km. including 0.66 sq. km. of Kanjia Lake and the area of Nandankanan wild life sanctuary is 4.37 sq. km. The park has a collection of about 1253 specimens of animals and birds representing 125 species (98 reptiles of 25 species, 674 birds of 60 species and 481 mammals of 40 species). Besides, Tiger safari, Lion safari, an Aquarium, Toy train, Boating and Aerial ropeway are some of the attraction of the zoo. Nandankanan has been identified as one of the four centres in India by the Central Zoo Authority to undertake captive breeding programme of the endangered Indian white backed vultures, gyps Bengalese's. Income from visitors is given by Table - 14.

An Eco-tourism scheme has been introduced in the State from 1995-96 to provide transport and accommodation facilities for tourists in Sanctuaries and National Parks. In the first phase, Similipal, Chilika, Bhitar Kanika and Nandan Kanan have been covered under the scheme.

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10

TOURISM AND TRAVELLER'S ECSTASY

- **Tourist Places**
- **Communication**
- **Architecture**
- **Accommodation**
- **Beautiful Temples**
- **Sculpture**

Odisha has vast potential for development of tourism which has remained largely untapped. The crowning piece of Odishan architecture and sculpture is a poetry in stone. The natural beauty of Odisha is full of wonders– sometimes tender, sometime awe inspiring but all the time exciting for the travellers. The enchanting sculpture and inexplicable natural beauty with biodiversity in flora and fauna, Odisha is a paradise for all types of travellers.

BHUBANESWAR (Ekamreakshetra)

In past, it was called *Ekamrakshetra.* It is believed that the residence of Lord Shiva is at Varanasi and his health resort is at Bhubaneswar. In greatness, it closely follows Varanasi. Like Delhi, Bhubaneswar has also been developed in two parts. On one half there are a plethora of temples, dating from 3rd century BC to 16th century AD and on the other hand one finds the modern capital-with offices, houses and shops etc. The rail track separate the **old** from the **new**.

Fergusson says, the trust fusion of dream and reality......perhaps the finest example of a purely Hindu temple in India, in reference to the Lingaraj.

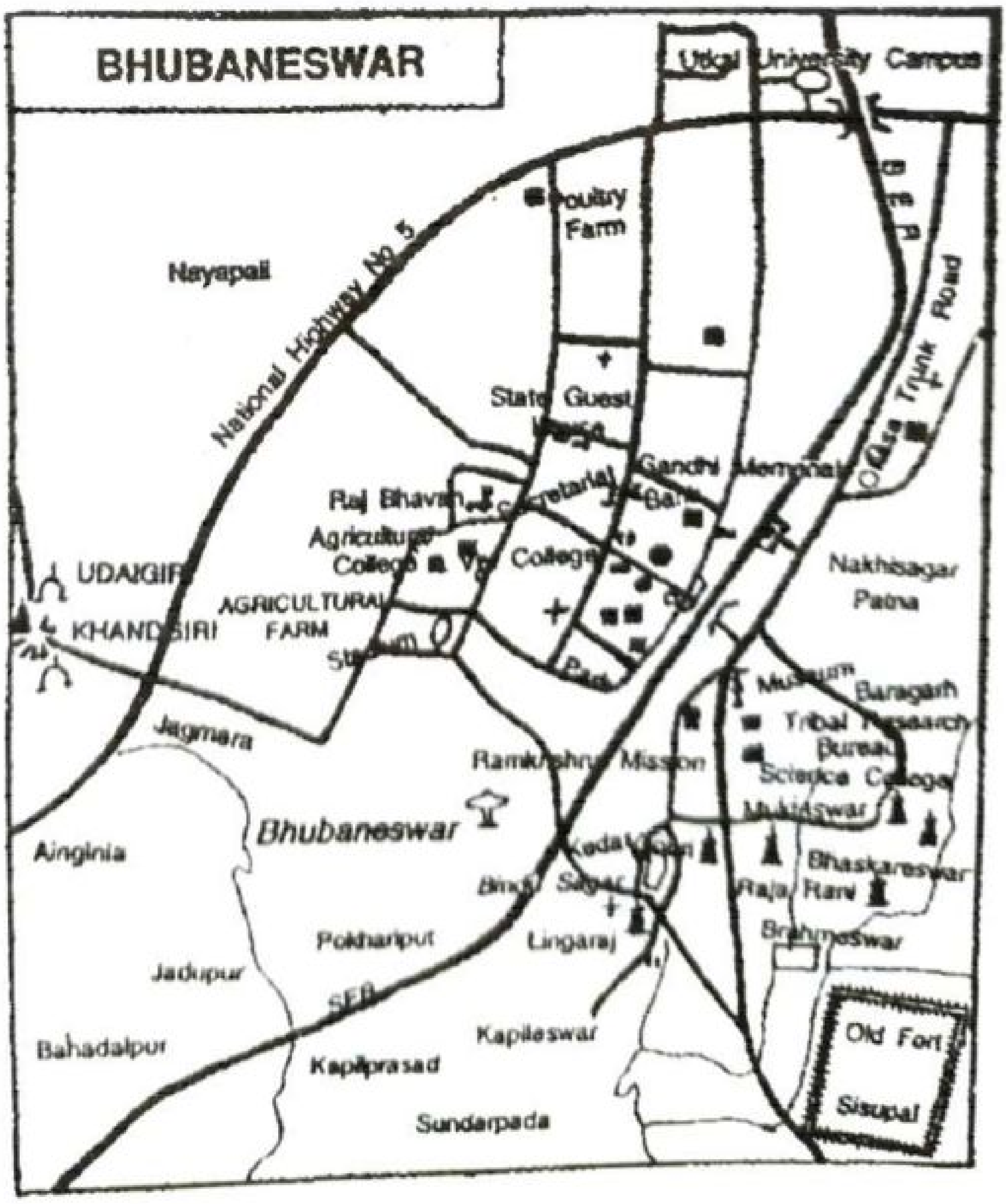
One of the renowned temple of Bhubaneswar is about 3.6 km from the railway station. The world famous **Lingaraj temple** the deity who is self-originated. He is parts Shiva and partly Vishnu i.e. Tribhubaneswar, who ruled Heaven, Earth and Hell. The name Bhubaneswar is also derived from Tribhubaneswar. In the Garvagriha (main compartment) of the temple, on a massive Shaktipitha umbrella shaped granite stone, 2.5 m dia (symbolising) Linga. Lingaraj is one of the 12 Jyotirlingas. Like Puri Rathayatra, Dolayatra and Chandanyatra are also celebrated here. From in the month of *Akshaytritiya* to the next *Shuklashtomi* Baisakh, generously decorated with sandal paste, the deity goes for Chandanyatra or boat tour. *Shivaratri* (worship of Lord Shiva) is another colourful and remarkable festival of this place.

This temple is surrounded by a 127 ft high, 7.5 ft broad boundary wall. The temple premises covers an area of 520 × 465 ft. This is a cluster of 108 temples. Built 100 years before the Jagannath Temple of Puri, it is smaller in size. Only Hindus are allowed to enter and any leather goods and cameras are prohibited. However, from a sort of platform on the north wall-built for Lord Curzon, non-Hindus can have a view of the temple. There are 3 entrances–the main entrance is in the east i.e. a pair of stone lions stand there as guard.

520 x 465 ft

The Lingaraja Temple 127 ft, 7.5 ft.

There are 8 *dikpals* (guardians of 8 quarters of the world) in the alcoves on the outer wall of the temple. To the north it is Kuber, to the east Indra, to the South-East Agni, to the south Yama, to the S-West Niriti, to the West God Varun. The decorative motifs and status of gods and goddesses carved or depicted on the walls are exquisite intercourse. But, the numbers of statues engaged in sexual intercourse are much less than those found in Konark or Puri.


BHUBANESWAR
Utkal University Campus
Poultry Farm
Nayapali
National Highway No 5
State Guest House
Gandhi Memorial
Raj Bhavan
Secretariat
Agriculture College
Vet College
UDAIGIRI
KHANDGIRI
AGRICULTURAL FARM
Stadium
Nakhisagar Patna
Museum
Baragarh
Tribal Research Bureau
Science College
Mukteswar
Jagmara
Ramkrishna Mission
Bhubaneswar
Ainginia
Kedar Gouri
Bindu Sagar
Bhaskareswar
Raja Rani
Brahmeswar
Pokhariput
Lingaraj
Jadupur
SER
Bahadalpur
Kapileswar
Kapilprasad
Old Fort
Sisupal
Sundarpada
Cuttack Trunk Road

There are other temples around this Lingaraj temple. They are in the south of Bhubaneswar. Immediately close to in Nishaganesha-a massive image of Ganesha, Kartik and Parvati. The delicate carvings of Nishaparvati are beautiful. The delicate decoration of the temples of Mukteswar and Parvati attracts the tourists.

About 300 metres north of Lingaraj is the Bindusarovar. According to the Purana, the name of this place was **Ekamrakanan.** It was a great favourite of Parvati. One day, while she was walking, she was chased by two demons Kriti and Bas. They wanted to marry her. Parvati argued on the condition that they would have to lift her

Bindusagare known as Ocean drop tank

upon their shoulders. As they did so, they were crushed by her weight. Parvati was tired and thirsty, when Shiva arrived. In order to quench Parvati's thirst, the Sarovar was created. All the rivers and rivulets etc. contributed drops of water as directed by the Lord. Hence the name is *Bindusagar* (drops of water). The 1400 × 1500 ft Bindusagar has a depth of [illegible] ft. The waters are very holy and those who bathe here are sanctified. Even the Lingaraj comes on birthday celebrations (*Ashokashtami*) to have a bath in the Bindusarovar.

On the eastern side of the Bindusarovar lies the **Anant Basudeb Temple.** This beautiful temple is dedicated to the Lord Vishnu. Bhavadev Bhatta the name of some inscribed on a stone. Probably it was he who established the temple. It is assumed that the sarovar was also dug out by him. However, specialists claim that Bhavadev Bhatta repaired. It is assumed the 60 ft high temple and the Bindusarovar and the temple was built in [illegible] by Bhima Dev's daughter, Chandradevi.

Siddhyaranya or Siddha Aranya, on the Bhubaneswar-Puri road, there was a spring of sweet water surrounded by mango trees. Today, the garden no longer exists. But, $15\frac{1}{3} \times 6$[illegible] ft Kedar-Gouri or Gourikunda is still there. On the bank of the Kedar-Gouri there is 9th century **Mukteswar** temple (20 ft high), with the deity, Shiva. In its architectural design the influence of Buddhism, Jainism and Hinduism are found. At the entrance there is a lotus shaped canopy in Buddhist style. Each petal takes the form of one particular God. On the top of two pillars there is a half-circle slab. In its strange structure the stories of the Panchatantra are depicted. The lattice work on the windows and the procession of elephants and horses in bas-relief are also unique. There are Saptamatrika and Nabagraha images in Mukteswar. The image of Ganesa with his mouse, Kartika on his peacock and a baby in arms are something new. Beside the temple there is *Marichi Puskarini* (pond). It is believed that a bath in that pond cures barrennes of woman. In the same premises, to the N-West of Mukteswar, is the incomplete Siddheswar Temple of the 11th century. Here, the standing image of the God Ganesa is also very beautiful.

About 1 km, south from Museum, opposite to Mukteswar temple, beneath a massive banyan tree, there is temple of **Parasurameswar–** with an image of Shiva. To the east, there are Gods with their companions; to the west is Shiva in Nataraja form. According to hearsay the 45 ft high *Kedar-Gouri* Temple was built in the 6th century. In Kedar-Gouri, one can see Shiva's wife Gouri-mounted on a lion, the beautiful Devi Durga, gorgeously decorated. One can also see the 8 ft high *Pavanputra* (son of the God of wind) Hanuman, the Gouri Temple of the 9th century and Gourikunda. Immediately after entering Kedareswar, do not forget to drink the waters of the **Dudhganga** to the left-it is believed to cure many illnesses.

A little distance away from Siddharanya, in the midst of a beautiful garden, the incomplete 58 ft high **Raja-Rani Temple**, built in 11th century, is also magnificent. Images are of bejewelled beauties, among creepers and leaves, leaning against trees, images of men and women in many moods and other Gods and Goddesses. The pillars are also well

Bhubaneswer is known as Cathedral city Of India

decorated. It is a pyramid shaped temple, with a peak at the rear. There are 8 dikpals to guard the 8 directions-South-Yama, S-West-Nihriti, West-Varuna, North-Kuber, N-East-Isha, East-Indra, S-East-Agni, N-West-Marut.

The Rajarani Temple

There are countless temples in Bhubaneswar and it is not possible for tourists to visit all. So, let go to **Brahmeswar** temple on the way to the capital of the state at a distance of 1 km east. The entire temple is filled with delicate sculptures of dancing girls, even figures in intimate poses. It was built in 1060 AD. The canopy of Jagmohan is shaped like a full blown lotus. It seems that it is a replica of Lingaraj. It is open to all. Opposite of it stands **Bhaskareswar.** There is a linga image of 3 m high.

Enthusiasts travellers can visit **Sishupal Garh** about 5 km from the city and to the S-East of Brahmeswar. In recent excavations, traces of a walled city have been found, at the time of Ashoka. Some coins of the Kushan era have also been found in the excavations. The Kalinga Emperor Kharbela reigned in this Sishupal. Then it was known as Toshali. Similarly, one should visit the 9th century Yogini Temple (here the image of goddess like a circle in Hirapur) at a distance of about 6 km.

A little distance from the Panthanivas, opposite Kalinga Ashoka in Kalpana Square, there is **Odisha State Museum** with its excellent archaeological collections of the architecture, artistry, clothing, shelter, music, armoury. There are also numerous tribal exhibits. With a particular reference to pictures on palmyra leaves. It is open every day besides Monday, 10-00-13-00 hr and again 14-00-17-00 hrs. There is also **Handicrafts Museum and Science Museum** on Bhubaneswar's Secretariat Road and a Planetarium on the National Highway No. 5 in Bhubaneswar. It is open everyday barring Monday between 15-00-16-30 hr. One should also go to the **Tribal Research Centre** to see specimens of tribal culture of the state. It is located on the N-West side of the city in CRP square and is open everyday except Sunday, between 10-00-17-00 hr. Tourists should not miss-Rabindramandap, Ram Mandir built by the Birla Group, the ISCON temple in Nayapalli and the Indira Gandhi Park opposite the Secretariat. It was in this park that Indira Gandhi gave her last public speech on the 30th of October 1984. There is also a statue of her. ✓

Nandankanan : Bhubaneswar is a city of temples. Hence, temple visit has a stronger appeal than that of newly built capital. Visiting Lingaraj Temple, on the way to Udayagiri, it is quite easy to make a tour of the city without getting down from the car or bus. But, you

built in 1960, 29th Dec, Lake near Nandankan
- Kanjia Lake
(5th largest zoo in India)

must not forget to visit Nandankanan, about 20 km from the city, covering over 426 hectares, beneath the blue sky. It means garden of the Gods. The **botanical garden and zoo** in Nandankanan truly worth viewing. Lake bifurcated the garden and zoo. Except Monday, it opens every day between 08-00-17-00 hr. Though it was opened only in 1960, it has a quite remarkable collection. There are more than 200 tigers, a strange form of breeding has resulted in progeny of white crocodiles and white tigers. There are also gorillas, a variety of lizards– the iguana, squirrel black panther, leopard, rhinos etc. in 1984 at a cost of over 27 lakh over 20 hectares of land, a **lion safari park** with 15 lions was opened to public. Except on Monday, a battery operated 19 seater protected bus operates between 09-00-11-00 hr and 15-00-18-00 hr. A 3 km path is to be traversed among sal and segun trees to take a glimpse of the daily life of lions. Lions having their dinner at 6 pm is of another attraction. After a day's fasting on Monday, the tigers and lions are served lunch on Tuesday at 11-00 hr. There is also a ropeway in the safari park. The cactus house of Botanical garden is wonderful.

In winter, migratory birds from a number of countries all over the world make a picturesque sight. There are elephants to carry tourists as well as there is toy train and ropeway. In Kanjia Lake extending over 134 acres, there are also various arrangements for boating. Furthermore, there is **Chandka Hasti Abhayaranya** (sanctuary) extending over an area of 189 sq km in Nandankanan.

The nearest railway station of Nandankanan is Barang on the Cuttack-Bhubaneswar railway. From Barang, one can go by rickshaw or may walk 2 km to reach Nandankanan. Nandankanan Special bus starts from Bhubaneswar at 9-30 hr. Private buses also ply. But package tour of 1 hr cannot meet the demand of the tourists. Entry fee in Nandankanan is Rs. 10/-. Guide is also available. Accommodation in *Nandankanan Tourist Cottage* and *FRH. AB* : Assistant Conservator of Forests. Nandankanan, PO. Barang, Dt. Cuttack.

Khandagiri and Udayagiri : 8 km from Rly stn Buddhist cave Udayagiri and Jain cave Khandagiri are located on a single hill of eastern ghat mountain, facing each other. It is also very near Calcutta-Chennai national highway. Immediately after getting down from the bus one can see to the left, the Jain cave *Khandagiri* (Broken Hill) and on the right the Buddhist cave *Udayagiri* (Sunrise Hill). In 2nd century BC at an altitude of 123 ft and 113 ft Khandagiri and Udayagiri respectively were built carving granite stone. Though it is placed lower, the caves of Udayagiri are far superior in number and in the appeal they hold for tourists. Even though Khandagiri might not hold that much of appeal, temples of Jain Tirthankara Mahavira (24th) and Parsvanath (23rd) were built in 19th century. A Hindu temple was built in 1970 at the peak of Khandagiri. On the way, there are numerous images of women and elephants carved in some Jain caves of Khandagiri. From the peak of Khandagiri, the airport, Lingaraj and Dhauli are all clearly visible. The hill top is crowded with black faced monkeys. Another major attraction is the gathering of all holy men on the two mountains during the last week of January.

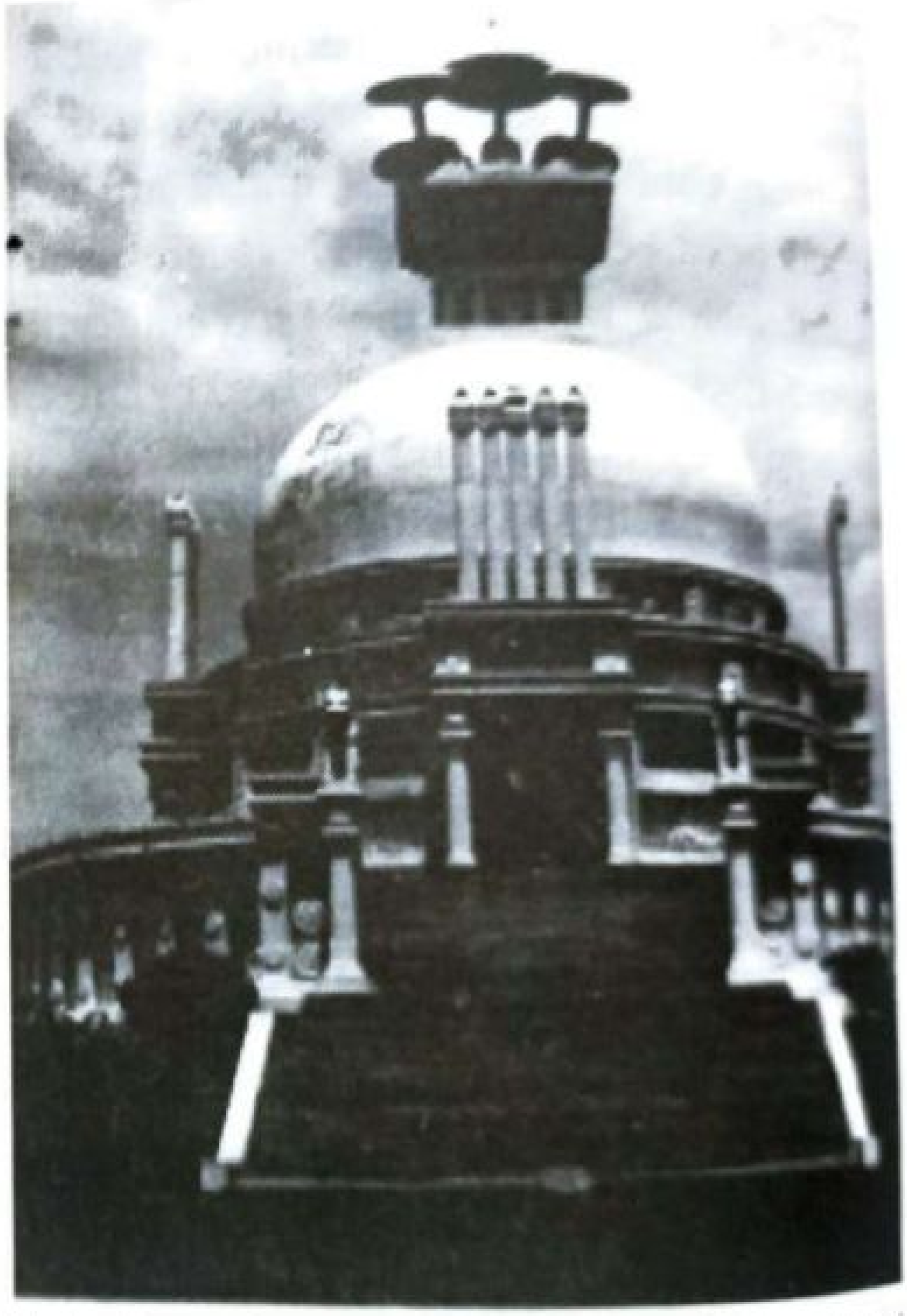
On the right, as one ascends the stairs to **Udayagiri**, one comes across the *Swargapuri* Gumphas first. Here, amidst the leaves and creepers on the walls, there is an elephant beautifully engraved. Then comes Rani Gumpha-1, a 2 storeyed palace curved out of rock on the N-East and west side of the hill. This cave contains a massive sculptor of 49 × 24 ft. A powerful elephant ready for battle, frightened monkeys, sword fighting, victory procession and scenes from the life of Kalinga Raj Kharbela are depicted here. In the brackets atop the pillar are images of elephants, women and dancers. Snake and Lotus which are holy symbol in Jainism are also depicted. Cave No 2 is also full of artistry.

The plain and simple *Hasti Gumpha* (No. 14) may be less attractive, but its value lies in the stone, where inscription of Pali language (deciphered in 1902) is found. As there is the *swastika* symbol on stone, some people believe that it is of the Buddhist.

Climbing up the mountain, to the left of the bus route, is Khandagiri. Visitors of Udayagiri should reach Khandagiri after having a look at the 11, 12, 13, 14, 15 Gumphas via Hasti Gumpha. Caves 1 and 2 are called the Parrot Gumpha. On the arch of the door, parrots have been carved. There are sentries at the door, wearing *dhotis* in Gumpha No.1 Gumpha No.2 built in the 1st century BC, is extremely attractive, both in its size and characteristic. Passing No.2, the Dwital Cave No. 3 and 4 are also full of sculptors. Lions catching prey, snakes and elephants and others. There is also two strange animal on top of the pillar. The artistry or handiwork in Cave No.3 or the Ananta Gumpha is also astounding. Cave No. 4 is ordinary. As there is a crack in Cave No.5, so the name is Khandagiri. Behind and on the right hand side of the Naba Muni Gumpha of Cave No.7 Hrishabhanath, Parsvanath and the seven Tirthankaras are carved. In the balcony, there are two images (12 ft approx) in Cave-8. Adjoining is Cave-9, or Trishula Gumpha built in 15th century. There are guards at door and inside the cave King Kharbela is engaged in prayer to the Jain god. But the sculptors in this cave are badly damaged. On the right side of hilly road there is Cave No.10 i.e. the Ganesa Gumpha, one can see elephant images, images of lions chasing prey and the story of abduction of Sita on the walls. On the walls of the balcony fables are depicted. From the ruins of highest Chaitya hall one can admire the beautiful scenery all around. Cave 11 – though little in size, Cave 12 – shape of which is like a face of tiger, 13, 14, 15 are all destroyed. Still, one of the main attraction of Khandagiri is the 2 Jain temple of 19th century of Parsvanath and Mahabir. This 2 temples are on the top of the peak and to reach there you have to climb a steep stairs from cave 10 or cave 5. In 1930, statue made of white marble were founded. It is believed that in the 6th century BC, the Jain Tirthankara, Mahavira, came to Bhubaneswar with the desire to propagate Jainism. He stayed in the Kumari Mountains or the *Kumari Pahar*, which is believed to be todays Khandagiri-Udayagiri Mountain.

Starting from Udayagiri, one can see Khandagiri within an hour. A road has been made through forests, amidst trees and creepers. The number of caves in Udayagiri and Khandagiri are 44 and 19 respectively. However, it is not possible to see all. One will face an acute lack of both time and patience. Though few in number, one can avail of buses, taxis, rickshaws from the city. There are arrangements of package tour to visit Udayagiri and Khandagiri from Bhubaneswar or Puri. It remains open 8-00–18-00 hr. An entrance fee is required at Udayagiri. In Hirapur, at a distance of 12 km, one can also see two jogini temples, *en route* Bhubaneswar.

22 km away from Bhubaneswar on NH 5 *en route* Nandankanan is Gouribari, it is the gate way of **Chandaka-Dompara Abhayaranya.** This sanctuary is surrounded by hills and mountains. In an area of 193.39 sq km there are 48 lakes where chita, sambar, elephant come to drink water. Besides, there are varieties of butterflies and birds of different species. Migratory birds also flock together in winter. Monkeys are also there. There is no accommodation in this sanctuary. But there is watch tower in Ambilo and Kamarkot. Permission is required from DFO, Chandaka Wildlife Division, Plot 8., Sahidnagar Bhubaneswar-751007, (0674) 2417977. Best season from Oct to March.



Dhauli : From the city, on the Bhubaneswar-Puri/Konark road, if one goes 5 km to the south and then 3 km to the right, one can find Dhauli. If one reaches Dhauli Chowk from Puri or Konark by bus and then goes 3 km on foot or by package tour one would reach Dhauli. One may avail rickshaw, auto or taxi to reach there. It was in Dhauli where the historic battle took place in 261 BC between King of Kalinga and Ashoka. Nearly one and half million people died in this battle. Being puzzled Ashoka took an oath-*not by sword, victory would have to be attained by love*. On a 5 × 3 m stone slab, in the Brahmi script, 13 edicts of Emperor Ashoka have been found in Dhauli. He declared-*All men are my children*. A snowy White Peace Pagoda has been built by Japan and the Kalinga Buddhist Sangha in 1970 on the top of mountain. Even a monastery has also been built. Images of Gautam Buddha (4 types) are placed there. Dhabaleswar Shiva's ancient temple at Dhauli is a tourist spot. Renovations have been carried out in 1970. Far below flows the river Daya, which was turned scarlet with blood in war.

Shopping : As mementos of the trip to Bhubaneswar, one can buy handicrafts and textiles of Odisha. The main shopping arcade is at Market Building Complex on the main road. There is the *State Emporium*-**Utkalika**-Rajpath, the *Odisha State Handloom Weaver's Cooperative*-J. N. Marg, *Odisha State Handloom Development Corporation*-Janpath, the *Mahila Vikas Samavay Nigam.*. Besides all of these, there are numerous shops and other shopping complexes under private ownership. Shops and establishments remain closed on Sunday.

Conducted tours : Odisha Tourism's Tourist Office, 5 Jayadev Nagar, Kalpana Chowk, opp *Museum*, Bhubaneswar–751002, Ph. : (0674) 2431515. Everyday besides Monday, buses ply from the Bhubaneswar Panthanivas at 9-00 hr. return at 17-30 hr after conducting tour at Nandankanan, Khandagiri-Udayagiri, Dhauli and Lingaraj temple. Tours are arranged at 9-00 hr for Pipli, Puri and Konark-arrival at 18-00 hr. Everyday OTDC bus goes to Sambalpur in 8 hrs, leaving at 22-00 hr for Berhampur daily at 7-00 hr in 4 hrs, fare Rs.100. It return at 14-30 hr. A variety of A/c and non A/c cars are also available on hire basis. Booking : Manager, Panthanivas, Ph. : 2431515. They also have counters at the Rly stn. and airport. The Government of India Tourist Office is located at B/21 Kalpana Area, Behind Museum. One can also avail taxis and autos to visit Bhubaneswar. Taxis also ply between Puri and Konark. Further one can visit all the temples of Bhubaneswar by a rickshaw for Rs.40-50. There are many private organisations who make arrangements for package tours. They also provide cars.

OTDC, Utkal Bhavan, 41 Lenin Sarani, Kolkata-13, arranges an economy package of 2 days 1 night at Chandipur-Panchalingeswar. The tariff includes the travel expenses and accommodation. They also arrange for week-end tours of 2 days 1 night to Puri-Bhubaneswar-Konark. Similarly, tours are arranged for Bhubaneswar-Konark-Puri. In all cases, food at ones own cost part booking for Panthanivas of Bhubaneswar, Puri, Konark, Taptapani, Chandipur, Lulung and Chilika-are arranged by OTDC. And, part booking of *Panthasala* and *Yatrinivas* of Odisha Tourism is also available at 55 Lenin Sarani, Cal-13.

Autri : About 40km from the city, Autri is renowned for its hot water spring. Temperature of water is 55°C. It contains sulphur. Skin diseases are cured. Hotokeswar temple is at Autri.

Distance of airport from the city is 4 km to the S-West Rly. Stn. and bus stand are available at the heart of the city within a radius of 2 km. Alliance Air 1 3 5 day reach Bhubaneswar 18-55 hr leaving Calcutta 18-00 hr. Hyderabad at 21-00; IAC 2 4 6 day leaves Calcutta 10-15 hr reach Chennal 13-30 hr via Bhubaneswar 11-10 hr. Alliance Air has flight for Delhi everyday. It leaves Bhubaneswar everyday 10-40 hr and reaches Delhi in 2 hr. To Calcutta on 1 3 5 day 8-05 hr. and on 2 4 6 day 8-30 from Bhubaneswar in 55 minutes. Alliance Air flight from Delhi everyday, it reaches Bhubaneswar 10-30 hr. And to Mumbai, on 2 4 6 day 20-25 hr. and on 1 day 16-35 hr. To reach Mumbai from Bhubaneswar Alliance Air takes 2 hrs 5 minutes. It returns at 16-55/13-05 hr. from Mumbai. Leaving Bhubaneswar 12-50 hr everyday flight reaches to Vishakhapatnam 13-15 hr and Alliance Air returns from Vishakhapatnam 9-15 hr. IAC flight to Chennai on 2 4 6 day leaving Bhubaneswar 11-50 hr arrival at Chennai 13-30 hr. Returns from Chennai 6-10 hr.

Bhubaneswar is 437 km south of Howrah on Howrah-Chennai rail. Many trains pl from Calcutta to Bhubaneswar via Kharagpur-Balasore-Bhadrak-Cuttack.

NH-5 goes to Chennai stretches from Calcutta via Bhubaneswar. From Sahid Mina buses of CSTC, ORTC and Hijli Samavaya bus go to Puri along the National Highway vi Bhubaneswar. Further, via Jaydev Nagar, Kalpana Chowk, between 4-00–22-30 hr. at interva of 5 to 7 minutes buses ply from Bhubaneswar, taking 1.5 hrs to reach Puri. From 4-00-24-00 hr buses ply regularly, taking 1 hr to reach Cuttack, 1.5 hrs to reach Konark, between 4-00–21-00 hrs, taking 5 hrs to reach Berhampore via Chilika, taking 7 hrs to reach Baripada via Cuttack/Balasore. Buses are available from Bhubaneswar to Rourkela, Sambalpur, Koraput, Sundargarh and various other directions. There are also sleeper coaches in many long distant buses which go to Sambalpur, Baripada, Visakhapatnam, Ranchi, Tatanagar, Raipur and other places from Bermunda new bus stand, Bhubaneswar. There are 2 bus stands in the city. Moving away from the National Highway, at the heart of the city is the Capital Bus Stand (Unit-2) and at a distance of about 5 km. N-West of the city the long distance new bus stand can be found in Bhubaneswar. There are also numerous private buses which ply from Bhubaneswar to all directions. Among the various modes of transport that ply in the city are city buses, tourist cars, metreless taxis and cycle/auto rickshaws. The tourists who go to Puri ought to avail conducted tour to visit Bhubaneswar.

Distance by Road from Bhubaneswar

Konark : 64 km,
Puri : 56 km,
Cuttack : 37 km,
Paradip : 121 km,
Jaipur : 121 km,
Chandipur : 205 km,
Similipal : 323 km,
Keonjhar : 235 km,
Rourkela : 514 km,
Sambalpur : 321 km,
Chilika : 94 km,
Gopalpur On sea : 184 km.
Visakhapatnam : 426 km,
Tirupati : 1172 km,
Hyderabad : 1063 km,
Calcutta : 512 km,
Hirakud dam : 336 km,
Mumbai : 1742 km,
Chennai : 1225 km

There is a distance of about 2 km between the railway station and the bus stand. Kalpana Chowk is in the midway. Ordinary hotels are found in this chowk surrounding museum. Ordinary hotels are also found in station square adjoining Rly stn. and throughout Bhubaneswar there are many luxury and star hotels.

On the bus route, in front of the museum, Kalpana Chowk, Gautam Nagar, Bhubaneswar, STD 0674, PC-751014, **H Kalinga Ashoka* of ITDC. A4 R1, A/c S 1700, D 1400 2000 Suite 3500. Adjoining it on the left OTDC's *Panthanivas*. Lewis Rd-14, Ph : 2431515, DAB 1000 TAB 750 A/c D 1700. **H Konark*, A/c Suite 2500. Bhubaneswar Municipality too has built a *Yatri Niwas* on the Cuttack Rd, in dormitory system, beds are for Rs.50 D 200 Hall 500. Food is also available in the restaurant.

Behind the Rly stn. on Kalpana Chowk-6 there is very popular *Bhubaneswar H* DAB 750-1500 A/c D 1600-2500 (TV), each room is provided with channel music and telephone facilities. *H Swagath*, is on Cuttack Rd-6, DAB 700-1000, *Birla GH*, S 180 D 300; *H Rajdhani*, D 600-1000. *H Siddhartha*, 19A, Cuttack-Puri Rd-6, D 1200 A/c D 1700-2000. *H Nataraj*, D 600 A/c D 1700-2000, *Bishram Bhawan*, D 700 Next to Kalpana Square-14. *H. Ekamra*, D 600-750 A/c D 2000; H Padma. S D 750-1500; *H Sunrise* 600-1200; Good for accommodation, *H Puspak*, DAB 700 A/c D 2000; H *Gajapati*, 77 Bhuddhanagar-14. D 750 A/c D 2000; *H Sahara*, 76 Buddhanagar-14, D 750 A/c D 1500-2000, *Samita L*, 77

Buddhanagar-6. S 100 D 250-650; opp *Kenilworth H* 86/A-1 Gautam Nagar, A4R1B2, A/c D 1750-3500 Suite 3700, *Bhagabat Nivas*, DAB 300-600 A/c D 2000; *Aristo L*, S 200 D 400; *Ratna D* 400-600; *H Trident*, Rajmahal Sqr-9 D 1000; *H Joyram*, D 600.

In Janpath-751011-**H Prachi*, A/c S 1600 D 1750-3000 Suite 4500; The latest 5 star hotel, *The Garden Inn*, Janpath-751001. Fax 0674-400053, D 2000 Delux 3000 Suite 4000, **H Swasti*, 103 Janpath-1, Fax 91-674-407524, A/c S 3000-4000 D 2295-2795. CB : 10 Meher Ali Rd. Cal-17, Telefax 91-33-2409534.

In Bapuji Nagar-Venus Inn, D 600-1200 A/c 2000; *H Janpath*, S 200 D 750 A/c D 2000; *H Casino*, D 600-2000; *H Rajmahal*, DAB 750-1500 A/c D 1700; *H Venus* Inn, D 750; *H Poonam*, D 750 A/c 1600-2000.

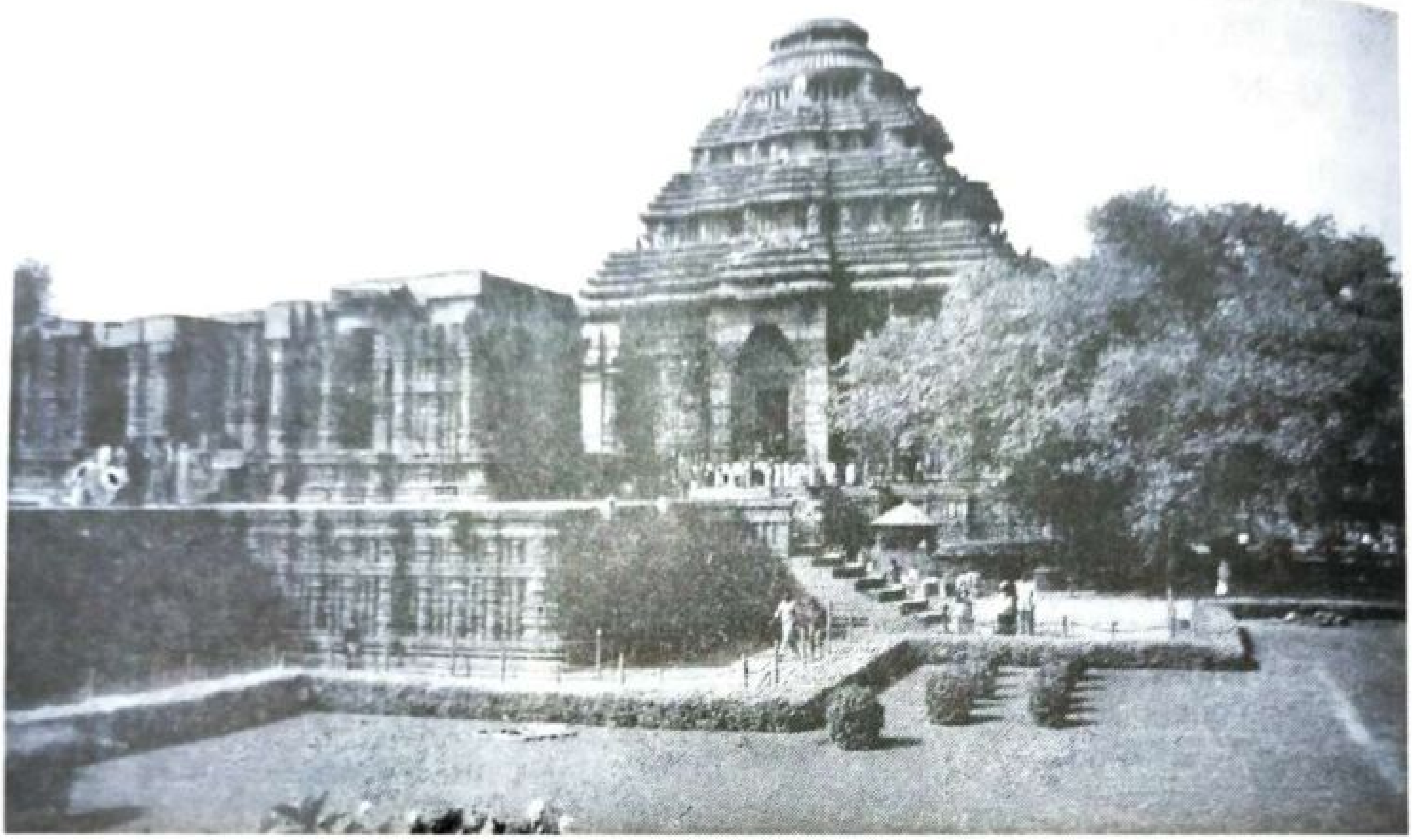
Near the railway station at Kharbela Nagar-1-*H Anarkali*, D 750 A/c S 1000 D 2000; *H Jajati*, D 750 A/c S 1000 D 2000 Suite 3500; *H Nupur*, D 750 A/c 1000 D 2000. In station square-*H Nandan*, D 300; *H Keshari*. S 600 D 1200 A/c S 1000 D 1600 Suite 3000; *H Richi*, D 750 A/c D 2000. *Tourist GH* Ph. 2400857, S 200 D 600 Sahid Nagar-*H Swapnapuri*, D, 400-750. In Raj Mahal Square- *Venus* L; D 600.

At Old Station Road- *H Lingaraj*, Near Railway Station, D 400-750, *H Jogendra*, D 400-750 A/c 1600; Out side platform Centrally A/c *H Grand Central*, D 1700-2050, *H Kamal*, S 200 D 400 * *H Oberoi*, Bhubaneswar, Plot-CB 1, Nayapali-13 A8R6, , A/c D 2500-4500; *H Rajarani*, Gouri Kedar S 200 D 400. Besides these, there are other hotels in Bhubaneswar.

Apart from these one also finds *Youth Hostel* in Khandagiri. AB : Tourist Office; *Retiring Room* at Rly Stn and Bus stand and other Dharmashalas-Dudhwala, Dalmia, at Rly Stn *Patangia* and of the Jains. There is also a *RH* of Ramkrishna Mission on the way to Lingaraj temple in Bhubaneswar. But, for accommodation star marked hotels and *H Bhubaneswar*, *H Pushpak, H Bhagbat*, at Kalpana Chowk; *H Gajapati*, *H Anarkali* or *Panthanivas* of OTDC get priority. They provide meal also. (SAB - Single attach bath; DAB-Double attach bath)

Food : *Anarkali*-Stn Square, *Vinith*-Stn Square; are renowned for vegeterian meals. *Padma-Pushpak* H. Kalpana Square, *Swapnapuri*-Sahid Nagar, *Venus Inn*-217 Bapuji Nagar, (3rd fl) well known for Nature and quality of meal is similar to Bengal-rice and fish curry etc. But local people prefer veg meal. One may take a taste of *Annabhog*, served at Lingraj temple with its uniqueness. There are many south Indian restaurants in Bhubaneswar who serve veg meal. *Modern South Indian H* is quite good. *Hare Krishna Restaurant* serve quality food in moderate rate. Similarly at *Surya Restaurant*, *H Prachi*, 6-Janpath, Indian Chinese, Continental and Mughlai, all sorts of dishes are served. *Sangam, New Kenilworth*, Gautam Nagar; **Swasti Executive*, 103 Janapath, Unit-3, Indian, Chinese and Continental food are available besides typical Odiya dishes, which are quite popular. At the same time, *New Ganguram Sweet* at the Stn. Sqr, *Dam Maharaj* at Satyanagar is famous.

This crowning piece of Odiyan Architecture and Sculpture **Sun temple** at Konar built in the 13th century A.D., the golden era of Odiyan art, is a poetry in stone and a worl heritage monument. The Mukhashala, or entrance hall continues to interest both devotees a visitors. The walls of this magnificent ruin have exquisite sculptures covering many aspects of life. Scenes of love and war, trade and court transactions, hunting, catching of elephants, teaching of sages, amorous dalliances, dancers and mythical figures-all vie for attention on the panels and niches of this immortal work of art.



Sun Temple – Konark

Surasundaris, heavenly damsels, freestanding, larger-than-life monoblock female statues playing the cymbals, drums, flutes or trumpets, adorn the top of the temple. Beautifully-carved couples engaged in myriad modes of amorous union, with their incomparable charms, are also attractions for connoisseurs of art as well as ordinary visitors.

Everyday the **Sun God** rises from the lap of the blue ocean close by and casts his first gentle rays on the *sanctum sanctorum* and then circles the temple during the course of the day, illuminating the three magnificent images of the **Morning Sun**, the **Mid-day Sun** and the **Setting Sun**. The colossal figures of the war elephants holding aloft a dazed soldier or the lions guarding the entrance to the temple or the enraged war-horses trampling under their hooves a fallen warrior-the last fittingly chosen as the emblem of the State are a testimony of Odisha's war time glory. And above all, the twentyfour giant wheels of this temple-chariot, symbolising the divisions of time with their intricate carvings on the spokes and the axleheads, the seven caparisoned horses representing seven colours of the Sun, the Nabagraha or Nine-Planet panel are living pieces of the glory of Odisha's past, frozen for a moment on the shores of time. **Konark** is a many splendoured gem of Odishan art. Its beauty is not for description in words. It is to be seen, enjoyed and savoured, not once but again and again, for it is truly a thing of beauty, a joy for ever.

Konark Festival

The Konark Festival held from 1st to 5th December every year in the amphitheatre is a most exciting dance events of the country. The festive nights serve the essential purpose of highlighting an important facet of India's composite culture. The immense backdrop of the Sun Temple looks breathtaking when illuminated in the evenings.

Museum

Run by Archaeological Survey of India, the Museum has an excellent collection of sculptures from the temple ruins.

Entry : Fee Rs. 20/- Friday closed

The Beach

A short walk, ride or drive from Konark, takes one to the beach known as **Chandrabhaga**, unspoilt by time and men. Quieter than Puri beach, it offers beautiful sunrise and sunset view at the beach.

Excursions

RAMACHANDI (8 km) Temple of Goddess Ramachandi on the confluence of river Kushabhadra with the sea and also a nice picnic spot.

BELESWAR (20 km) Saiva shrine and sea beach.

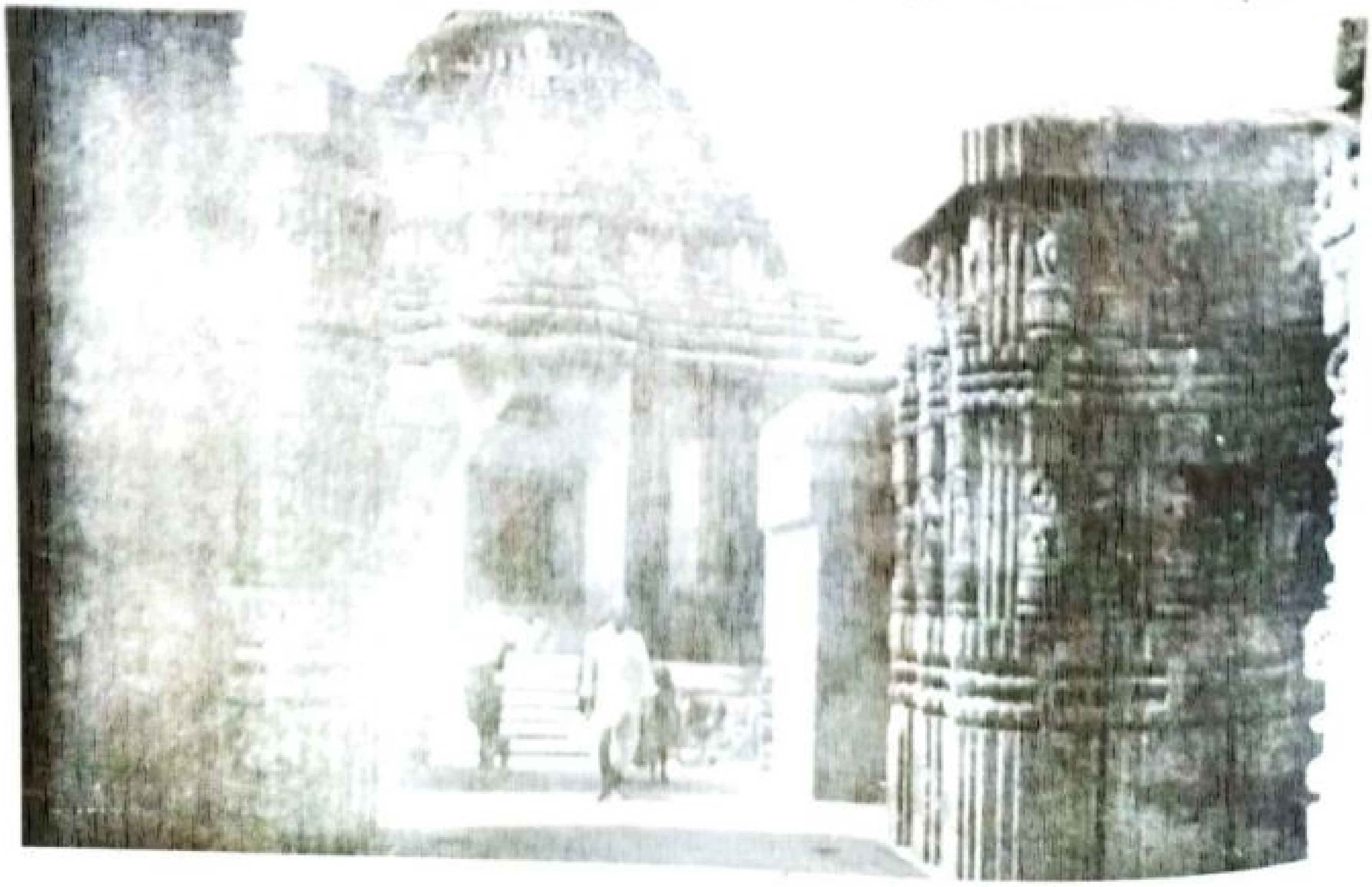
BALIGHAI (25 km) Sea beach and Sea Turtle Research Centre.

KAPILESWAR (10 km) Saiva shrine on desolate sand dunes.

KURUM (8 km) Excavated Buddhist site.

KAKATAPUR (25 km) Shrine of Goddess Mangala on river Prachi.

CHOURASI (35 km) Temple of Goddess Barahi, a typical order of temple architecture.



Approach

Air-Bhubaneswar is the nearest airport 65 km. Indian Airlines has flights from Delhi, Calcutta, Visakhapatnam, Raipur, Hyderabad, Chennai and Mumbai.

Rail and Road : The nearest railheads are Bhubaneswar and Puri. 65 km from Bhubaneswar and 35 km from Puri on Marine Drive, Konark is connected by good all-weather motorable roads. Public and Tourist bus services and taxis are available.

Accommodation

STD Code No. 06758; Country Code No. 0091. **Yatrinivas** of State Tourism; **Panthanivas** and **Travellers Lodge** of O.T.D.C; **Inspection Bungalow** of P.W.D. and other hotels.

Kurum : The village Kurum is located at a distance of 8 km from Konark. Specimens and exhibits of 7th and 8th century have been found in this unknown village. In this century Hinduism and Buddhism were merged with each other. However, in Hieun Tsang's writings (634 AD) Kurum has been referred to as a wealthy, prosperous and well populated village.

Among the numerous specimens there are a sort of script on stone, ancient coins. Buddhist caves etc. which were recovered from the underground of UGME School. Enthusiasts can take an auto or a car from Konark and may visit the thatched room of the teacher Sri Braja Das adjoining the school, where these specimens are kept under his supervision.

Puri : Puri has great appeal for both tourists and pilgrims, of the 4 great *dhams* of India. Others are– Badrinath, Dwarka and Rameswaram. Puran says, Lord Jagannath bathes at Badri, changes cloth at Dwarka, takes meal at Puri and sleeps at Rameswaram. Pilgrims come to see world famous temple of Jagannath, believed to be an incarnation of Lord Vishnu or Sri Krishna. A lovely sea beach is also an attraction to the tourists. There is no comparison of Puri sea beach. Swargadwar or Sea Beach Road is much more favourite to the Bengali tourist. Similarly, newly developed Chakratirtha area is also crowded today. But to whom religion is the last word they gather around Grand road adjoining the temple. It is said that if one stays for 3 day and 3 night, he would certainly reach heaven after death. Puri is on the shore of Bay of Bengal.

Trains from Puri reaches Calcutta in 11 hrs. Delhi 32-36 hrs. Chennai 22 hrs. Khurda Rd 1.5 hrs (Passenger train), Bhubaneswar 1.6 hrs., Patna 21.6 hrs,. Tata 10 hrs,

Odisha in 10 Days

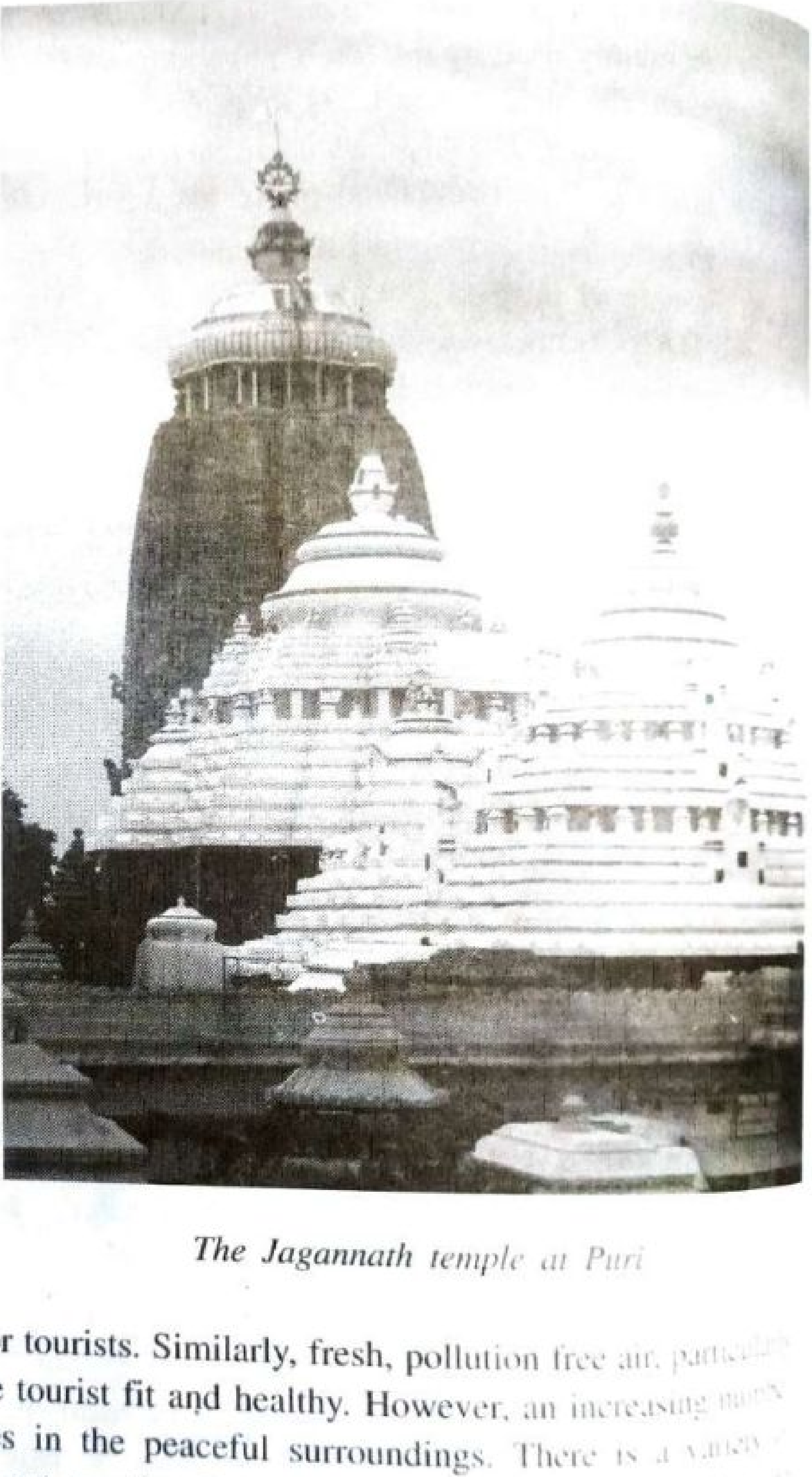
Availing Chennai Mail from Howrah via Bhubaneswar/Khurda Road get down at Berhampur and visit Gopalpur-on-sea by bus. Stay and visit at Gopalpur and returning to Berhampur on 2nd day, visit Taptapani by bus; night halt at Taptapani or Berhampur, 3rd day, in the morning take a bus to Rambha or Balugaon and visit Chilika and in the evening take the Vyzag Exp./Bus and reach Puri. Temple visit on the 4th day and take rest. 5th day in Konark and Bhubaneswar in a package tour. Spend 6th day to enjoy the sea beach. On the 7th day take a bus to Cuttack and have a look at the city. On the 8th morning, take a bus for Jajpur town and Spend the day in seeing the city. One may reach Keonjhar, Similipal or Balasore by bus. You can go to Chandipur from Balasore on the 9th day. On the 10th day return Calcutta.

There are several trains coming to and going from Puri. The arrival and departure time of trains is generally changed in every year. Some important trains for reservation are given below.

Important Train Name

(1) Puri – New Delhi Neelachal, Express via Tata (2) New-Delhi – Puri via Tata (3) Puri – New Delhi via Adra (4) New Delhi – Puri via Adra (5) Puri – Patna-Baidyanathdham Express (6) Patna – Baidyanath - Puri Exp. (7) Puri – Haridwar Utkal Exp. (8) Haridwar - Puri Utkal Exp. (9) Puri – New Delhi Purusottam Exp. (10) New Delhi – Puri Purusottam Exp. (11) Puri – Darbhanga Exp. (12) Darbhanga – Puri Exp. (13) Puri – HWR - Jaganath Exp. (14) HWR – Puri Jaganath Exp. (15) Puri – HWR - Exp. (16) HWR – Puri Exp. (17) Puri – Tirupati Exp. (18) Tirupati – Puri Exp. (19) Puri – HWR-Garib Rath Exp. (20) HWR – Puri Garib Rath Exp. (21) Puri – Guwhati Exp. (22) Guwhati – Puri Exp. : (23) Puri - Ahmedabad Exp. : (24) Ahmedabad – Puri Exp. : (25) Puri – Dwarka - Okha Exp. (26) Okha – Dwaraka - Puri Exp. (27) Puri – Hatia Tapaswini Exp. (28) Hatia – Puri Tapaswini Exp. (29) Puri – Jodhpur Exp. : (30) Jodhpur – Puri Exp. etc.

Puri is one of the coastal cities of India. Here the sea is wild and turbulent. Every moment, dashes with enraged waves the semi-circular Bay of Bengal. Waves come and dash on the yellow sands of the blue sea leaving white foams. From early morning to mid night sea beach is always crowded with tourists. The sea is not very deep. bathing begins right from the morning. For the inexperienced tourist, it is advisable to seek the guidance of the Nulias, at the time of bathing. However, one can enjoy bathing in the sea if one follow the rhythm of waves and float accordingly. One can also take the help of a rubber tube and then get into the water. Inspite of all precautions, the sea at Puri is not bound by any norms or regulations– it is whimsical. Recklessness often leads to danger. Collection of shells is another attraction of Puri. A wide variety is found on the golden sands and it becomes virtually an addiction for the young and the old, to collect them. The sunrise and sunset at Puri is also another magnetic attraction for tourists. Similarly, fresh, pollution free air, particularly in the morning and evening keep the tourist fit and healthy. However, an increasing number of hawkers are causing disturbances in the peaceful surroundings. There is a variety of fishing boat at Puri. The fishermen put together 3 to 4 pieces of wood and set sail in the deep sea. The boats seem to fly like birds.



The Jagannath temple at Puri

Another main attraction of Puri is **Jagannath Temple** or **Sri Khetra**. Area of Jagannath temple is 670 ft × 640 ft and it is surrounded by a 20 to 24 ft high wall. There are 4 entrances on 4 sides-*Singhadwar* (lion gate), *Hastidwar* (elephant gate), *Ashwadwar* (horse gate) and *Khanjadwar*. Main entrance is east facing. In front of it Aruna Stambha a 34 ft high statue of chlorite stone. A statue of Garur is also at its top. This stambha was brought down by the kings of Khurda from Konark in 18th century. 2 lions are guarding the gate.

Similarly, horses, tigers and elephants to the south, west and north gate. After climbing 22 steps one reaches the temple premises. The premises too is 22 ft high. Again the rectangular shaped wall of the temple is of 424 × 315 ft having 4 gates. Bhogmandir is on the east. Its area 58 × 56 ft. Natmandir which is on 16 pillars, covers an area of 80 sq ft. Jagmohan (80 × 120 ft) is on the west. And behind Jagmohan there is Biman. Its area is 80 sq ft and height is 192 ft. Crossing the second wall one will find numerous Hindu Gods and Goddessess. Vishwanath of Kasi, Ramachandra, Jay Vijay, Badrinarayan, Radha-Krishna, Batakrishna, Mangaladevi, Markandeyaswar, Bateswar Linga, Indrani, Suryadev Kshetrapal, Narsimhadev, Ganesh, Bhusandikak, the wife of Balaram – Tantrik Devi Vimala, Lakshmi-wife of Jagannath, Sharbamangala, Kali, Suryanarayan, Pataleswar, Shetalamadhav, Buddhadev, Gaurangadev etc. In other word all pilgrimages mingle at Srikshetra. One will also find the Sthambha or Pillar at the end of Natmandir touching which the Lord Sri Chaitanya used to become immersed in thoughts of Lord Jagannath. Even today devotees try to feel some sort of contact with Sri Chaitanya on touching the impression of his palms on the Stambha. According to legend, Sri Chaitanya merged with the Lord at this place. On the walls, there are also various images of men and women engaged in dressing. The carving, sculpture of the temple as well as the images of the Gods and Goddesses– both have an attraction to the tourists. In the interior walls of the temple, *Patachitra* (a form of painting typical of this region) of Puran based stories and the etchings on the Bas-relief of the stambha are unique and attractive. The variety of subject matter and the brightness of the colours are to be mentioned. Similarly, occupying almost half of the wall on the opposite the *Garbhagriha* (the rooms where deity is placed) there is picture of the *Dashavatar* (10 incarnations) which is also unique- here instead of the Buddha. Lord Jagannath himself has been depicted as the 9th incarnation.

On the bejewelled dias of the main temple, there are the 7 images Balaram with the white colour face. His companion is the black faced Jagannath with a diamond on his forehead and between them the yellow faced sister, Subhadra. Beside them, there is Sudarshan Chakra and on the left is the Lakshmi made of gold, Saraswati made of silver and at the rear, Nilmadhab. The Main God is made of the Brahma wood. The year in which there are two new moon in the month of Ashar, the remaking of the image of God begins. This ceremony is called Nabakalebar. In 1996, this ceremony was observed in pomp and splendour. Baikuntha Dham is situated to the north of temple and outside the boundary wall. Before starting the remaking of new image, the old image of the deity is to be buried in Baikuntha Dham. This is the custom. There are 6000 *purohits* (priests) and over 20000 workers who maintain their livelihood from the temple. There are 96 religious distinctions of birth amongst them. There is division of labour according to the *Chhatishaniyoga* beginning from *Dev seva* (serving the God) to all the other nitty grities. The world's largest kitchen is also located in this temple. There are more than 400 cooks, 200 ovens and a variety of more than 100 types of *Mahaprasad* (the Bhog of the Gods) is being cooked here everyday. Each day more than 10000 devotees consume over 70 quintals of rice and during festival, nearly 2.5 lakhs pilgrims or devotees get Mahaprasad. Mahaprasad can also be bought in the temple's **Anandabazar**. There are a variety of prices for different categories of Mahaprasad. Remnants of this Mahaprasad cannot be left-every morsel has to be consumed. The doors of the temple remain open from 6-00–24-00 hr. However, from the new moon in the month of Jaistha to the new moon in the month of Asad, the God becomes sick, so it is forbidden to look at him. Photography is strictly forbidden in side the Temple premises. Enthusiasts can take pictures from the Raghunandan Library Bhawan on the opposite side. Non-Hindus can see the Temple from this premises (9-00–12-00 and 16-00–20-00). But donation is to be given to the library for this purpose. The 8 m high tower has Vishnuchakra and Pataka at its peak, which are visible from a long distance. Devotees can also tie a flaf after purchasing it from the temple office. Very recently the Jagannath Temple has been renovated.

Gundichabari : Gundichadevi was the wife of Indradyumna, King of Avanti. He was the king who built the Jagannath Temple. Mausi Temple adjoining the bus stand is surrounded by a boundary wall. Lord Krishna came to Gokul from Brajadham and in memory of that in the month of Asad-Shravan (July), Jagannathdev with his sister Subhadra and elder brother Balaram use to spend their leisure time. After an interval of 9 days, they return to Sri Mandir. With a procession of 3 chariots–(13.5 m high 10 sq m and 16 wheels with a diameter of 2.1 m) Lord Jagannath come to his aunt's house from Srimandir. The distance between the two is 2.5 km–along the GT Road. First chariot is of Balbhadra. Subhadra is second and lastly Jagannath. This festival/procession is called **Rathayatra.** The route of return journey is same like that. This is called *Bahura* or *Ulta Rath*. After the return of God the wood of the Ratha or chariot is sold to the devotees as souvenirs. Pilgrims from all over the world come here to be part of the Rathayatra. As a matter of fact, even Chaitanyadev once pulled the Chariot. After sweeping the road by the king himself the chariot is drawn by the thousands of devotees and once it is moved, it does not stop. New chariot is made every year. The construction begins on *Akshaya* Tritiya (a particular lunar constellation) and the stumps of 1072 trees are used to make 2188 bits of wood which are finally used to construct the *Nandighosh* or *Garuddhwaja* (13.5 m) i.e. Lord Jagannath's Chariot, the *Darpadalana* or *Padmadhwaja* (11.5 m) i.e. Subhadra's chariot and the *Taldhwaja* (12 m) i.e. Balaram's or Balabhadra's chariot. Besides the main God/Goddess, each chariot has place for 9 other Gods and Goddesses–2 sentries, 1 chariot driver and 1 *Dhwajadevata* (Flag God) or Shirsadevata. Each is made of wood. The 3 main deities are decorated with a 1600 m brightly coloured cloth. Once the Nabakalebar or the new image of the deities are constructed the old ones are buried in the Baikuntha Garden along the north gate. Besides this 62 religious festivals are observed every year in the Jagannath Temple.

Now, let us go on foot or by rickshaw at a cost of ₹ 70-100 for a roughly 3 hrs tour to cover Puri. After visiting at **Siddhabakul** or the place where Jaban Haridas attained salvation, go ahead to **Gambhira** i.e. the residence of Kasi Mishra.

It was in this residence that Nimai lived for 18 years, between 1515–29th June 1533, the day of his demise. Even today the articles he used like Kantha, Kamandul and *Paduka* are worshipped. On the 1st floor, the *Chaitanya Leela* also ought to be seen. If one takes a dip into **Shweta Ganga,** which has reference in the Brahma Purana and is on the north of Sri Mandir one will acquire merit. **Yasheswar** is very close to Sri Mandir. It is believed that the results of worshipping Yasheswar is the same as worshipping Koti lingas. Similarly, the *Chandan* or Sandal-wood festival at the Narendra Sarovar is also a remarkable festival. Every day replicas of the God Jagannath and Madanmohan come to this sarovar for bathing. A temple has been built in the midst of the Sarovar. After visiting Basudeb Sarbabhaum's house one may go to the **Markendeswar Temple** and **Sarovar.** It is towards the south of the Sarovar, the water is holy and brings merit. It is believed that Lord Vishnu also stayed on the bank of the Sarovar under a Neem tree. About 3 km from the Srimandir, to the west is the **Lokanath–** a Shiva Temple. After visiting Ramanand's house, Chandan Sarovar one may visit cemetery of Bijay Krishna Goswami, built in 1318 AD. Opposite of it the cemetery of Kuldananda Brahmachari, who was a disciple of Bijay Krishna Goswami. This cemetery/ temple was built in 1345. Atharanala and Laxmijala are floating below. In 1300 AD **Atharanala** Bridge (85x11m) was built on the river Mutia. In the past, Atharanala was the gateway of Srikhetra. This bridge is of an excellent form of art. There are 18 holes in this bridge. At this place, pilgrims at first pay their respect.

To the N-West of the Jagannath Temple, the **Indradyumna Sarovar** is another pilgrim spot. One is greatly benefitted by bathing here and offering special prayers to one's ancestors. There are turtles in the water. Further, in the **Chakratirtha,** Gouranga image made of gold is also there. Lord Krishna with a flute in his hand and idol of Gopal beside him are there. Immediate after Sankatmochan, on the left Gouranga of Nadia on the sea coast, there are temples of *Sani* (Saturn) at Chakratirtha.

Sakshigopal or truth teller's temple is beautifully decorated. Having been gratified by the prayer of his devotee, Lord Krishna came from Vrindaban to Kalinga to bear witness under certain conditions. Because of violation of these conditions he disappeared and took the form of a statue. A temple was built there in course of time. This temple is 17 km to the north of Puri on Puri-Bhubaneswar bus route. It is said that Puri tour cannot be completed without seeing Sakshigopal. Though it requires ₹ 10 (₹ 10 for Puja and ₹ 10 for remuneration) for worshipping but priests pester devotees. So one should be cautions at the time of Sakshigopal visit. Photography is strictly prohibited.

New attraction of Puri is **Beach-Festival**. It was been started in 1993 and is observed in the month of December adjoining beach near Swargadwar. Main attraction of this festival is dance, music etc.

Raghurajpur is located near Chandanpur on Puri-Bhubaneswar road (Chandanpur 9 km) and from Chandanpur 1.5 km to the right level crossing and more 1.5 km from the level crossing. This last 1.5 km is shadowed by coconut tree. Raghurajpur is famous for its mythological paintings on pot. The artists are painting on palm leaf, tasar and even on coconut in a special manner. Prices of this painting are between ₹ 80 to 225.00.

Shopping : As a momento, one may purchase *Patachitra* from Raghurajpur, status from Pathuriashahi, applique work from Pipli and a variety of shells and conch shells, silver jewellery, Kotki saris from Cuttack, Sambalpur silk, Mayurbhanj silk, Tassar silk, Gamcha (a sort of local towel) from Khurda road and images of the God made of wood from Puri. Shops along the Grand road adjacent to temple are ideal for it. One may visit *Utkalika* and the *Kotki Sari Emporium* run by the Odisha Govt. A branch of this emporium has been set up in Swargadwar, opposite Bharat Sevashram Sangha, its name is *Kotki Emporium. Sudarshan* on station road is a popular shop for the items made of stone. A number of shops are found along the beach. There are a whole plethora of shops on the beach in the evening. There is almost a tug of war between the shopkeepers and buyers regarding prices.

One important fact the travellers to Puri must keep in mind is not to become a victim of absurd rumours. As a matter of fact, while travelling, a lot of people sometimes offer hotel bookings, package tours, train tickets etc.– even giving a receipt in exchange. It is true that tourists are sometimes swindles even in hotels and lodges. If there is any problem in giving money, they even accept signed vouchers. Helpless tourists/passengers quite often fall prey to their sweet talks and are put to no end of trouble. So, the best option would be to go directly to where tickets or reservations are made-in a proper and bonafide manner.

On 3rd July, 2009 in Railway Budget, three new trains have been introduced from puri. These trains are (1) Puri-Kamakha Superfast Express, (2) Puri-Mumbai via Sambalpur Lokamanya Tilak Express and Puri-Surat Express via Sambalpur. Again Raipur-Bhubaneswar Express, Paradeep-Bhubaneswar Express and Howrah-Bhubaneswar Dhauli Expres have been extended up to Puri. Puri Station is selected among 50 "World Class" stations to be developed with public private partnership. The doubling of railway line from Khurda to Puri is completed.

Chilika

Nestling in the heart of coastal Odisha, Chilika is India's biggest inland lake. Spread over 1,100 square kilometres, it runs along the borders of three districts of Puri, Khurda and Ganjam and finally joins the Bay of Bengal through a narrow mouth, forming an enormous lagoon of brackish water.

Dotted with many emerald green islands with colourful names such as Honeymoon Island and Breakfast Island, Chilika is home to a rich variety of aquatic fauna. It is also a sanctuary and winter resort for migratory birds, some coming from as far as Siberia.

Containing a large variety of fish, the lake provides livelihood to thousands of fishermen. Hundreds of boats sail out daily on the Lake's blue expanse in search of mackerel, prawn and crabs–the sight providing an insight into the pageant of rural India at its colourful best.

Encircled by hills all along its arched shape shores Chilika lake's colour changes with passing clouds and the shifting sun. The water ripples languidly, occasionally dancing with the gentle breeze from across the Bay of Bengal.

ATTRACTION WITHIN THE LAKE

NALABANA : An asylum for long-range migrants in winter.

BIRDS ISLAND : A haven for resident and migratory birds.

KALIJAI : Abode of the island Goddess "Kalijai".

SATAPADA : An ideal place for viewing cavorting dolphins.

BRAHMAPURA : A place of scenic beauty.

PARIKUD AND MALUD : Colourful islands within the lake.

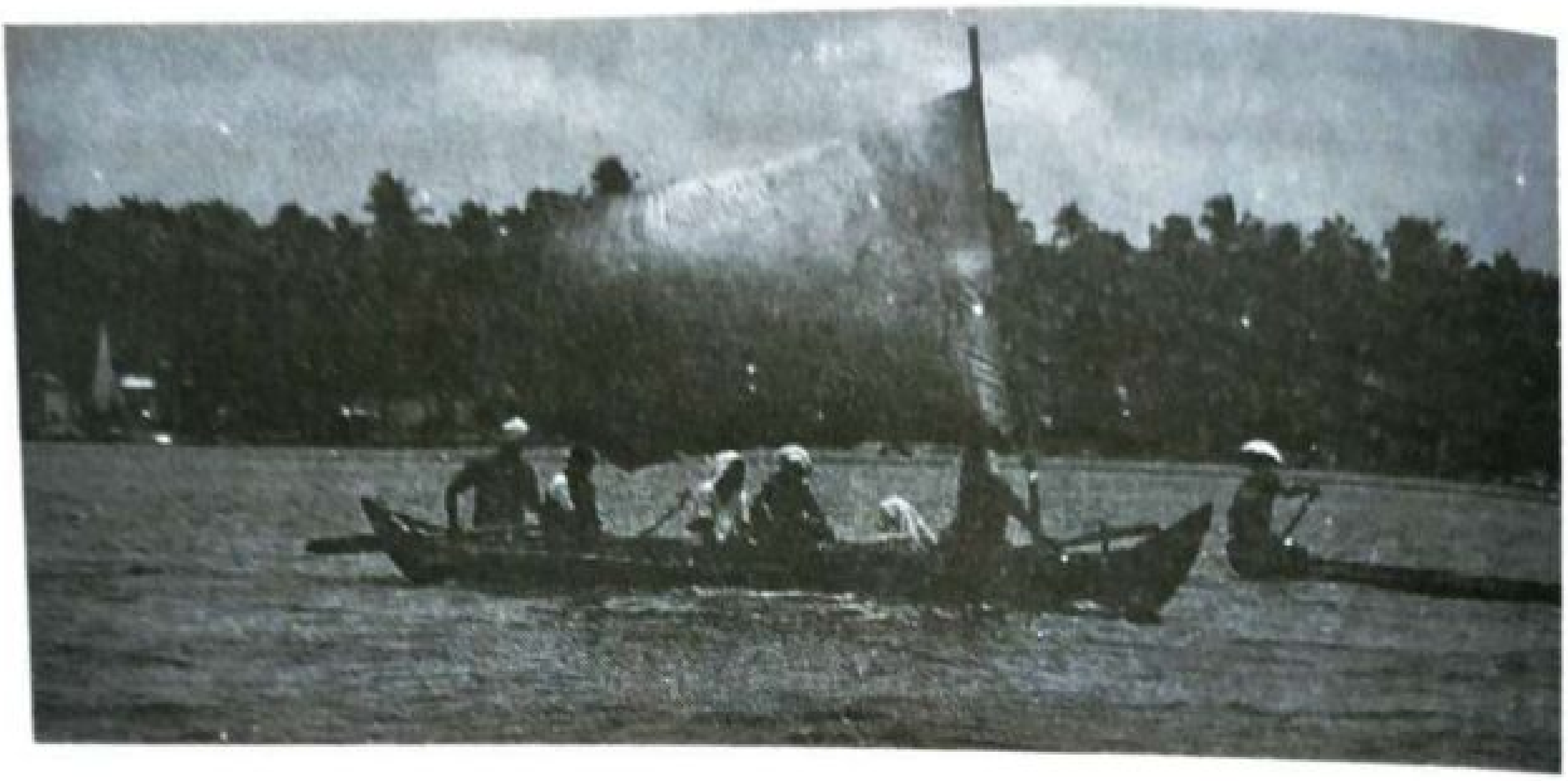
EXCURSIONS

NIRMALA JHAR : (11 km from Rambha and 21 km from Barkul)

A place of religious worship as well as a picnic spot of great interest.

NARAYANI : (10 km from Barkul and 22 km from Rambha)

By the side of a perennial stream, the shrine of Goddess Narayani adorns the place. It is also an ideal place for pleasure and relaxation.



BANPUR : (13 km from Barkul and 8 km from Balugaon)

A centre of religious activities revolving round the time-honoured shrines of Goddess Bhagabati and Dakshya-Prajapati.

TAPTAPANI : (125 km from Barkul and 100 km from Rambha)

A pleasant health resort with a hot sulphur spring having medicinal properties. The water of the spring is channelised to bath-tubs of the Panthanivas for steam-bath.

GOPALPUR-ON-SEA : (75 km from Barkul and 60 km from Rambha)

An ancient sea-port, it is at present a favourite seaside resort.

APPROACH

AIR : Bhubaneswar is the nearest airport – 105 km from Barkul and 130 km from Rambha and 110 km from Satapada.

Indian Airlines has flights from Delhi, Calcutta, Visakhapatnam, Raipur, Hyderabad, Mumbai and Chennai.

RAIL : The Calcutta-Chennai rail route of East-Coast Railway touches Chilika lake at Balugaon, Chilika, Khallikote and Rambha. The nearest Railway Station for Barkul is at Balugaon (5 km) and for Satapada, at Puri (50 km).

ROAD : The Chennai bound N.H. No. 5 linking Calcutta-Cuttack-Bhubaneswar-Balugaon-Barkul-Rambha-Berhampur and Visakhapatnam runs along the lake.

Buses and taxis to Chilika are available at Cuttack, Bhubaneswar, Puri and Berhampur. Autorickshaws are available at Balugaon for Barkul.

OTDC and other private tour operators provide luxury coaches and cars from Puri and Bhubaneswar (both A/C and non A/C) at reasonable rates.

CRUISE

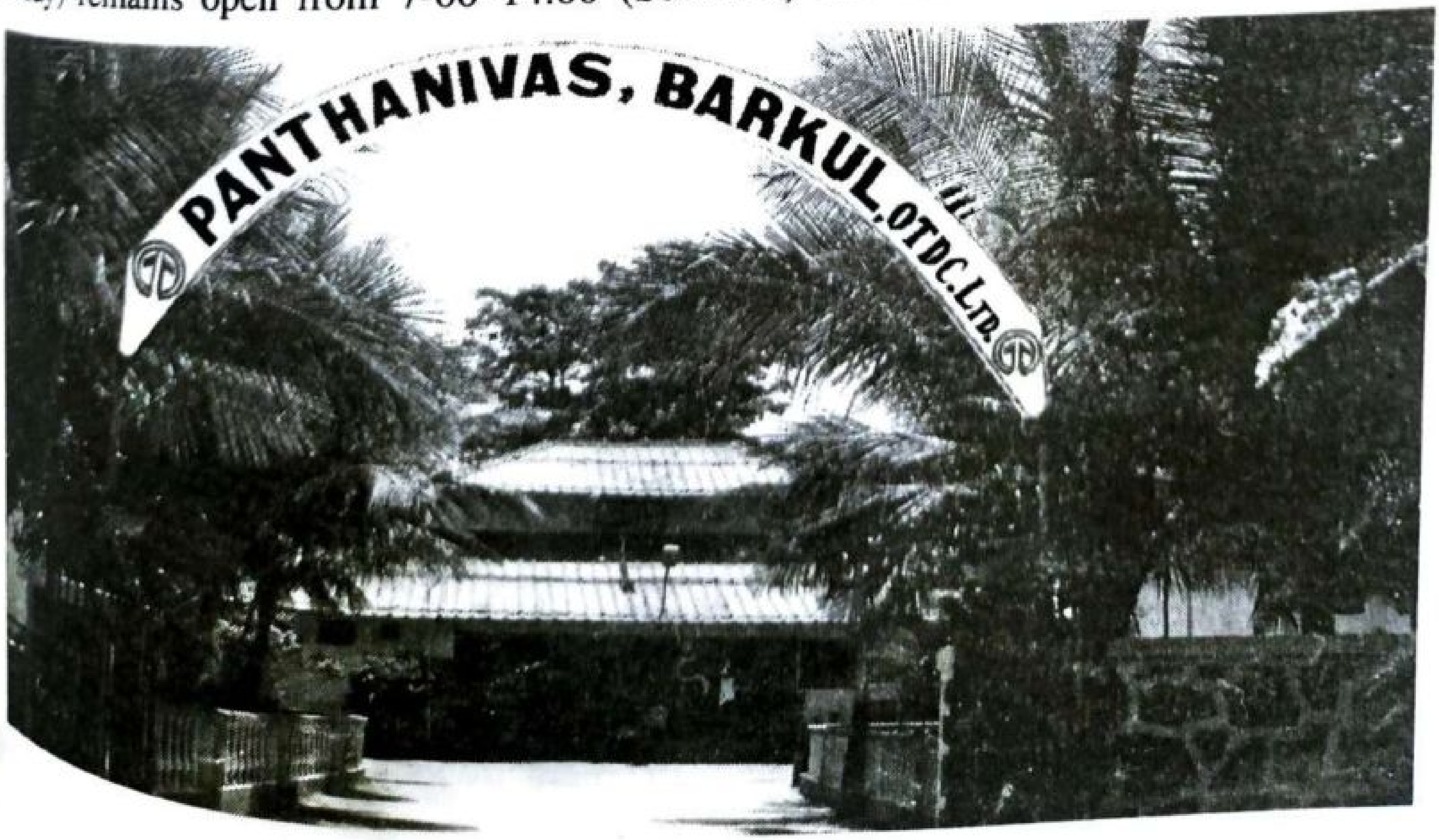
Motor launches of OTDC Ltd. are available at Barkul and Rambha, and of the Revenue Department at Balugaon. Country boats can be hired from private operators at these places and at Satapada as well.

ACCOMMODATION

Panthanivas at Rambha of OTDC, Tel. (06810) 57346; **Panthanivas** at Barkul of OTDC. Tel. (06756) 20488 and **Ashoka Hotel** at Balugaon, Tel. (06756) 20408/20409 and **Yatrinivas**, Satapada, Tel. (06752) 45564.

Ganjam : You have to reach Berhampur (Ganjam) (603 km on the Hawrah-Chennai rail line) availing East Coast Exp., Falaknuma Exp., Tirupati Exp., Chennai Mail, Coromondal Exp. triweekly Trichi Exp.(1 4 7 day). Thiruvananthapuram Exp., Guwahati-Thiruvananthapuram, Guwahati-Cochi and Guwahati-Bangalore Exp from Howrah. It is a journey of approximately 12 hrs. Besides these, one can also avail Konark Exp from Bhubaneswar, the Hirakhand Exp., which arrive Chilika in 4 hrs from Berhampur. DMU Locals also run between Berhampur–Bhubaneswar. If reservation is not available then one may arrive Calcutta via Bhubaneswar by bus or train and from there by Dhauli Exp. or Satabdi Express.

Berhampur : Ganjam district is very rich in picturesque beauty of Odisha. Ganjam is a Persi word which means the store house of grains of the world. Along with mountains, hills and forests there is a beautiful sea coast in Ganjam. The district Hq is in Berhampur. Though in particular Berhampur is not an attractive tourist centre, but it is the main business centre of the district. Silk sarees, handicrafts of Berhampur are also famous. Thakurani, Jagannath, Nilakantheswar Shiva and other temples are there in Berhampur. Museum (except Monday) remains open from 7-00–14.00 (Summer) and 10-00–17-00 (Winter).



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The new bus stand is of 3 km from the rail station. There are numerous bus link to Calcutta, Puri, Sambalpur, Jeypore, Waltair etc. Frequent bus services are available to reach Bhubaneswar. Deluxe bus of the OTDC leaves Bhubaneswar at 7-00 hr and arrives Berhampur at 11-00 hr along NH 5; it returns Bhubaneswar from Berhampur at 14-00 hr. State Tourism office is at Old Christian St and Rail Station (Berhampur).

There are different types hotels in Berhampur. At a distance of 2 km. both from the bus stand and rail station, on the way to the stadium at Town Hall Road. Berhampur-761026, STD 0680 : *Municipal GH*. D 250 A/c D 1000-1250 opp *Berhampur RH*, Convent School Road, DAB 300-500 A/c S 1000-1200; Towards the Stadium, at the old bus stand-*L. Radha*, D 300-500; on the opp: *Udipi H. D* 300-500; *H Radha* D 300-500; *H Poonan; Sriram Bhawan*. D 200-300 in Gandhinagar; *H Moti*, DAB 300-600 Suite 700-1200 A/c 1200-1800. Near railway station, on Station Rd : *Aurobindo L.* D 200-300; *New Bhabani L. H Gitanjali*, D 200 both are equal in fare and quality. On City High School Road–Durga *Bhawan L*, D 300-400; *Sri Ramnivas L, Ananda Bhawan L.* On Ram Lingam Tank Road – *Lake view L.*, D 200-400; *H Anarkali*, D 200-400; *H Shankar Bhawan*, D 200-400. On UB Road– *Girija L.*.D 200; *Bharati L*. D 150, *H Siddhartha*, D 200; *Luxminivas L.* D 200-400. On Satyanarayan Temple Road– *Indranivas L.* D 200; *Welcome L* and others. *Railway retiring Room* is also in Berhampur. *Muncipal GH., H Radha, Berhampur RH* and *H Moti* are ideal for accommodation. So far as food is concerned, the privately owned *H Mayur*, adjoining the *Municipal* GH is the best one.

Mahendragiri Hills : Buses ply from Berhampur (175 km) to different parts of Ganjam district through forests, mountains, Journey includes superb scenic beauties of forest, river, ups and downs, natural beauty of lush green carpet-like vallies etc.To reach 1500 m high Mahendragir; hills you have to come Parlakhemundi from Berhampur. From there via Palasa bound bus to Jiranga (36 km). From Jiranga 11 km trekking for the final journey to Mahendragiri. A pride of easternghat mountain, Mahendragiri is full of mountains, rivers and nature and the centre of Kalinga culture. As far as eye goes there are innumerable mountain peaks. The sea too is visible from the mountains. The distance is 20 km. It is also rich in minerals e.g. mica, condalite, charnokite etc. The great poet Kalidasa wrote his Meghadutam in stunned amazement of the picturesque clouds at Mahendragiri. There are references to Mahendragiri in the Ramayana and Mahabharata (Hindu epics) too. If one climbs up at a steep height of 100m, he will reach the peak of the mountain. A beautiful but simple mountain temple has been built by granite stone, in memory of the Bhima, Judhishtira and Kunti. On top of the hill there is Gokarneswar Shiva temple, oldest temple in Odisha. Far below flows the Mahendratanaya River. Lovers of nature can visit this place by bus or jeep. There is no accommodation in this mountain region. However, in Parlakhemundi, one can stay in bungalow.

Jougarh : 35 km from Berhampur is Jougarh. Inscription of Ashoka (discovered in 19th century) depicting *all men are my children* and others relics are found here. At Buddhakhol, 2 km from here, various remnants of Buddhist era have also been found. Route : By bus from Berhampur to Purushottampur and from there to Jougarh.

Taptapani : 50 km to the west of Berhampur is Taptapani, which means a hot water spring. Water contains sulphur, best for skin diseases. There are also arrangements for bathing in this spring. The mountain region starts from Taptapani. On the bus route, at a height of about 500 m, in shaded forests and amidst picturesque mountain scenery, there is 8 bedded OTDC's *Panthanivas*, Taptapani, Po-Pudamari, Dist-Ganjam-761014, Ph. : (06814) 247531. DAB 500 FAB 750 Suite 1200. One may get food in the canteen. Prices are excessive here. Through direct pipe spring water comes into the bath-tub of Panthanivas. Slightly below is the deer park. At a distance of half km is the pit of hot water. There are very few shops, but ordinary tea stalls are found near the hot water pool adjoining the bazar or market. One can also find the *Revenue IB* opposite the Panthanivas. Buses of different routes ply throughout the day from Berhampur to Taptapani. The ORTC runs only 1 bus during the day which leaves Berhampur at 7-00 hrs and arrives Taptapani in 2 hrs; it returns at 9-00 hrs from Taptapani to Berhampur. Puri-Raigarha buses too go to Chilika/Berhampur and Taptapani. One can also start early in the morning and return at the end of day from Berhampur to Taptapani. One can hire taxis or autos from Gopalpur at a cost of Rs. 1000-2500 to reach of Taptapani.

Chandragiri : Parlakhemundi is on the border of Andhra Pradesh which lies on this route. If one goes further 35 km to the west, there is Chandragiri on the plateau. It is covered with trees like sal, mahua. In 1957 Tibetan refugees came to reside at this place permanently. They run their society on the basis of a commune. Gumpha or monastery, Tibetan carpet, handicrafts are main features of this place. There is also a Tibetan Guest House.

Phulbani : You can make a trip to Phulbani, which is 127 km from Berhampur and return on the same day. ORTC bus leaves Berhampur at 5-00 and 12-30 for Phulbani. Distance of Phulbani from Khurda Road is 183 km. This place is at a height of 1500 ft and populated by tribal people. Tribals in their colourful dresses are the main attraction of Phulbani. Traces of earliest civilization are found in them. Natural beauty of Phulbani is also alluring.

For accommodation *H Rabi Shankar, Guru L* at Bus Stand H Venkateswar. Besides, there are PWD IB, CH, FRH at Phulbani-762001.

Daringbari : In the Phulbani Dist, at a distance of about 135 km from Phulbani and at a height of about 4000 ft lies the **Kashmir of Odisha**, i.e. Daringbari. It is surrounded by mountain. In this quiet, lush green valley sandal wood, pepper and coffee are being cultivated. Due to a picturesque natural beauty, Daringbari has become a very attractive tourist centre. It is also renowned as a summer resort. There are a lot of tribals who are deeply influenced by Christianity in this region. There are a few Churches too.

Due to a paucity of direct buses, one can avail ORTC bus from Berhampur or take a private bus to Baliguda or Sorada or after reaching Phulbani change bus once again and reach at Daringbari. One also has the choice of making a 7 hour journey from 330 km away

Bhubaneswar to Daringbari via break journey at Phulbani. If one desires, he may start journey from Taptapani taking about 4 hrs to reach Daringbari. There are no hotels in Daringbari, however, in *PWD IB*. AB : EEPWD, PO-Baliguda, Dist-Phulbani, Odisha; *Forest Bungalow* rooms are also available. Food is also available at ordinary hotels.

Kalahandi : This is a hilly, forested area. Though it is not popular in tourist map or as a tourist spot, but numerous tourists go there to enjoy the great natural beauty. Overnight buses ply from Bhubaneswar (a distance of 418 km) coming to the Dist Headquarters of Kalahandi. **Bhabanipatna** : Bhabanipatna is located at a distance of 104 km from Balangir, 71 km from Titlagarh and 247 km from Phulbani. Besides ordinary hotels like *Pushpa, Apsara, Robi* and *Ruchi* and there are numerous other hotels and lodges in Bhabanipatna. There is also *PWD IB*, AB : EE.R & B Div, Bhabanipatna; *CH*, AB; Collector, Kalahandi, Bhabanipatna. There are also temples-Manikeswari in the palace (*Rajprasad*), Gopinath, Bhavanishankar, Jagannath and Madanmohan and others. Phulrijharan Waterfalls which comes down from a height of 16 m and is located 15 km away is a tourist spot, it can be visited by hiring a jeep for about Rs. 1000-1500. At a distance of 25 km there is Jhakam Tiger Project.

Enchanting sea beach
of Gopalpur-on-sea

Accommodation at the Jhakam Forest Bungalow, AB : DFO, Bhabanipatna. It will be wise to take ration if anybody likes to stay at bungalow. In Karlapat, at a distance of 32 km surrounded by forested hills, one can see Manikeswari's ancient temple and the waterfall. The Goddess of Kalahandi, Devi Manikeswari, resides in the Dukri Temple (*mandir*), which is located at the foothill of the Mountains.

Gopalpur :

Hardly 16 km from Berhampur, the hub of southern Odisha, is the tiny town of **GOPALPUR** on the Bay of Bengal. Enjoying the reputation of being a popular Beach Resort

of Odisha, the deep and clear blue waters instantly provoke those who are good swimmers. The temptation of bathing here is irresistible. Not-so-good swimmers take the hands of the Nolias (local fishermen who help bathers) and enjoy a pleasant bath. White surf splashing on the golden sands makes Gopalpur-on-Sea as one of the finest beaches on the eastern coast. A fascinating haunt for avid beach combers and sea worshippers, it is a splendid retreat.

Watching the life on the beach is also exciting. The fishermen pulling their catch or mending their nets add local colour. Beautiful objects made of seashells available in abundance are worth buying souvenirs for decorating a Drawing Room or giving some one a present. Sand sculptures here and there made by some local artists are a feast to the eyes. Mouth watering sea food, especially fish from the deep sea, satisfy the hungry stomach. Green-coconuts quench the thirst.

Intense heat of the summer is temperated by the sea breeze in the fantastic quietness of the beach amidst palm, coconut and casuarina trees.

Gopalpur was once buzzing with maritime activities which Odisha is known for ages. It was one of the outlets through which early settlers of South East Asia sailed off. It was a famous and popular seaport during the British Rule till about 1942 when it ceased to operate due to the Second World War and separation from Burma (now Myanmar). The crumbling walls and pillars and the light house stand witness to the past port. Remains of several bungalows and mansions belonging the European merchants give the place a colonial look. A modern port is being developed here to revive the lost glory.

A trip to Gopalpur-on-sea is a rewarding experience of sun and sea, fun and frolick.

APPROACH

Road : Gopalpur is well connected by an excellent all-weather road which branches off from the NH 5 on the outskirts of Berhampur (16 km). Regular bus services are available. Taxis and Autorickshaws are also available.

Rail : Nearest railhead is Berhampur (16 km) on the East-Coast Rly. served by a number of fast trains on Kolkata-Chennai route.

Air : Nearest airport is Bhubaneswar (190 km) and Visakhapatnam (260 km).

ACCOMMODATION

Hotel Oberoi Palm Beach, Fax : 0680-282300, E Mail : p.beach @ dtc. vsnl. net. in, *Hotel Mermaid, Hotel Song of the Sea, Sea Side Breeze, Hotel Holiday Home, Hotel Kalinga, New Wroxam House, Hotel Rohini, Tourist Home, Holiday Inn, Hotel Sea Pearl, Hotel Green Park, Sea View Lodge, Millennium Plaza, Panthanivas*, OTDC, *Hotel Rosalin, Sai Tourist Lodge, Youth Hostel, Carey Centre, Hill Top, Hotel Natraj Guest House* and a few others.

EXCURSION

There are a few places of interest around Gopalpur to which day trips can be made.

Berhampur (16 km) : An important commercial town of South Odisha, Berhampur is an ideal market for shopping. The market displays a dazzling array of Odishan Handicraft and Handloom products. Prominent among them are Silk Sarees and Horn Toys.

Taptapani (65 km) : Set against the evergreen thick forest, Taptapani is known for its hot sulpher spring, a bath in which during winter is so refreshing. Even during other seasons, the scenic beauty of the place is amazing. During rainy season, clouds roam around the foliage. There is an OTDC Panthanivas with bath tubs directly connected to the hot spring.

Mahuri Kalua (30 km) : En route to Taptapani, Mahuri Kalua is another scenic spo There is a Shrine of Goddess Kalua in the deep greenery of nature.

Patisonapur (30 km) : Down south of Gopalpur, on the border of Andhra Prades Patisonapur is another beach. Quiet and secluded, this is a wide and clean beach across th river Bahuda.

Taratarini (30 km) : On the bank of the river Rushikulya near the village Purushottampur, the shrine of the twin Goddess Tara and Tarini adorns the hilltop amidst natural beauty. There is a flight of about one thousand steps as well as pucca motorable road from the foothill to the hilltop. The shrine is considered to be a Shakti Pitha of Tantra Cult. Now Temple Trust has constructed ROPE Way just like Mansa and Chandi temple Rope way at Haridwar.

Jaugada (35 km) : About five km further from Taratarini lies Jaugada, famous for the Ashokan Rock Inscription like the one found in Dhauli near Bhubaneswar. Large number of old bricks, tiles, potteries, beads, terracotta objects and punch marked coins of Mauryan Age are found in the suburbans. There is also a ruined fort. It stands as an insignia of the ancient heritage of the Rushikulya Valley Civilization that once prevailed in the area.

Chilika (Rambha) : (45 km). On the sprawling Chilika Lake, Rambha is famous for its scenic beauty and bird sanctuary. Covering an area of about one thousand square kilometres, lakhs of resident and migratory birds of different hue make Chilika their home during winter. Boating in the lake is enjoyable in all seasons. There is also the Shakti Shrine of Kalijai for a Pilgrimage. Rambha is on the southern end of the pear shaped lake amidst calm and serene environs. There is an OTDC Panthanivas for night stay.

Cuttack : Cuttack is located at a distance of 409 km from Calcutta on the Howrah-Bhubaneswar-Chennai E.Co.Rail. Besides Sri Jagannath Exp any other train bound to Bhubaneswar will pass via Cuttack. However, it is the Dhauli Exp which leaves Howrah and reaches Cuttack at 12-55 which seems to be the most convenient. The Puri-Delhi Exp, Nilachal, Utkal-Kalinga, Purushottam and the Weekly (1 day) Puri-Patna Baidyanath Exp, Rajdhani Exp – all these trains run via Cuttack. There are numerous other passenger trains which have stoppage at Cuttact e.g. Cuttack-Paradeep, Cuttack-Dhenkanal, Cuttack-Bhadrak, Cuttack-Khurda Road, Cuttack-Bhubaneswar, Sambalpur-Puri and the Howrah-Puri.

From Kolkata buses leave from the Shahid Minar at 16-00 hr and reach Cuttack at 5-00 hr the next day. It returns at 19-30 hr from Cuttack to Kolkata. Further, buses also go to Gopalpur, Pattamundai and Puri via Cuttack and Bhubaneswar. There are numerous buses which arrive Cuttack from different places of the state. The nearest airport is Bhubaneswar, at a distance of 28 km. Day and night bus and train have connected the capital and Cuttack. At a distance of 3 km from the rail station, in the heart of the city, is the Badambari bus stand.

At a distance of half km from the rail station, two and half km from the bus stand on Ice Factory Road, College Square, Cuttack-753003, STD 0671, one will find-Aurobindo *Bhawan*; A little distance away, on the opp side is *H Ashoka*, Ph. : 2613508; *H Vijaya*, Ph : 2613560; *Bombay H*, Ph : 2613097, *Cuttack H*, Ph : 2610766. On Pilgrim Road-3, one will find- *H Ambika*, Ph : 2610137, *Sreekrishna Lodging*, *H Anand*, Canal Bank Road-3.

Opp. the Badambari bus stand-9-*H Roxy*, Adjoining, under the same ownership, *Roxy L*; On the right hand of the bus stand *H Malanga*. On the left side of the bus stand, *H Monalisa*, *Ashok L*, if one takes a right turn *H Bishal*, opp Puri Bus Stand, Badambari-12, and then again to the right on Mahatab Road-1, *H Basanti*, immediately beside it *H Sree Jagannath*. To the left of the Main Road on Dolamundai Square, Cuttack-753001, – *H Sagar*. On the opp side *H Akbari Continental*. On Bajrakabati Road-753001, at the intersection of the rail and bus route, at Bajrakabati Road 753001– *Dwarka Hotel*.

2 km from the bus stand, in Buxibazar, Cuttack-753001, OTDC's *Panthanivas*, Odisha Tourisms Tourist Office is also located in the Panthanivas.

Even besides these, there are numerous other hotels throughout the city-*H Bishram*, Jayprakash Marg-12, *Stadium GH*, *H Sailaza*, R3B2, *Ramchandra Lodging*, Manglabagh, *H Lords*, *Shiva Bazar*-1; *H Trimurti International*, Link Road, *Debalok Lodging*, Madhupatna-10. *H Anand Bhawan*, Bajrakabati Road, *Indian L*, Mani Sahu Chawk, *Santosh Bhawan*, Banka Bazar, *Indrapuri L*, Machhua Bzr. Besides these, there are other ordinary hotels. There is also the CH. PWD IB and the Railway Retiring Room at Cuttack. Newly opened H.Maitry at Choudhury Bazar DOB 500, DOB A/c 900, Single A/c 750, Single Non-A/c 400.

But *Monalisa, Dwarka, Bijoya, Roxy, Basanti, Anand* and the *Panthanivas* get priority. For food, immediately outside the bus stand, to the right of the main crossing. on Dolamundai Square *Veneathe* and opp-*New Kalika South Indian H* are popular.

Even a few years ago (1956) Cuttack- the head-quarters of Cuttack Dist was the capital of Odisha. The foundation of the city was laid between 920-935 AD by the king Kesari. In 989 AD, the city was named after the military camp i.e. *Cuttack*. The 8 years reign of ruler Mukundadeva when Cuttack was forcibly taken over by the Mughals and the Afghans of Bengal– in time, it came under control of Marathas and then under onto the British (1803). The British built up Odisha joining together 26 regions of India and made Cuttack its capital. To the north Mahanadi and to the south Kathajodi-these 2 rivers flow along the 3 sides of the city. The shape of which is island like. Towards the south of the island, on the Kathajodi river, the 11th century dam, made of granite stone achievement of the Kesari kings. This dam was built to save the city from flood. But death seems to linger in many guises Cuttack-in 1885, there was a terrible drought, in 1992 more than 200 people died after consuming poisoned liquor. The city too is rather overcrowded and polluted.

In the 14th century, the Ganga dynasty king Anangabhima built the **Barbati fort** on the northern bank of the Mahanadi. There is a deep moat on all 4 sides–the 2 sides are surrounded by 2 boundary walls made of stone–which played a very important role in the past. It was in this fort where the last Hindu king, Mukund Harichandan had his 9 storeyed palace. Although it is in poor condition, but the main gate (*Sinhadwar*), the moat, Jagannath Temple and Bakshi Sahib's *Majaar* (burial place of Muslim holy saint) can be seen. Opp to this, covering a 25 acre land, there is the Barbati Stadium in a very pleasing environment. On the way one can also visit **Katakchandi Temple, Kali Temple** infront of Odisha High Court is situated at Kali Gali. In Chowdar village, there is the **Kapaleswar Fort.** Inside the fort one can find the **Chorganga Pukur** (pond). It was named after the Utkal King Chorganga. At the end of the city is the Paramhansa Shiva Temple. At the heart of the city is the **Ravenshaw Collegiate School.** Netaji Subhas Chandra Bose in his childhood studied in this institute. Similarly, in Subhas Chandra's ancestral house, **Jankinath Bhawan**, a national museum has been set up. This also has great tourist value. Besides this, in the heart of the city at the top of a dome, there is the 18th century **Quadam-I-Rasul.** 3 beautiful Mosques well decorated with carvings and etchings is surrounded by a wall. Here, one can find Prophet Muhammed's footprints in a circular stone, brought from Mecca. There is **Ravenshaw University** which has been declared as Deemed University near Railway Station. In front of Ravenshaw University, there is a famous book store, **Kitab Mahal**.

Shopping : As a memento of the trip to Cuttack, one may purchase filigree work done in gold and silver wire, articles made of brass and horn and of course the Kotki sari which is widely appreciated throughout the world. One will find the best filigree work in Naya Sadak, Balu Bazar or the gold and silver shops adjoining Quadam-I-Rasul. Similarly, in Utkalika and Big Bazar, located on Jail Road, one will find numerous souvenirs of the Cuttack tour.

Satkosia Gorge Sanctuary : The river Mahanadi 900 km long river flows piercing the mountain and reaches at **Tikarpara,** 33 km. from that place. The name Satkosia has been derived from the 7 crosh stretch of Mahanadi. Largest Gorge of India has been made– Satkosia Gorge. Though it is a calm and quiet river, it is 40 ft deep. At an average height of 350 m and comprising Dhenkanal, Cuttack, Puri and Phulbani District. This sanctuary has an area of 795.52 sq km. There are sal, teak, asan, kurum trees and elephant, panther, bear, sambar, bison are found in this forest. Different species of bird are also one of main attraction. Temperature; in summer 47° C, in winter 40°C. Average rainfall 1300 mm/ humidity 80%. Tourist season Oct-May.

Arrive at Badambari bus stand by rickshaw from Cuttack Railway Station. From there along NH 5 if one goes 13 km., he will reach Choudwar. On left NH 42, along this highway Dhenkanal 41 km, Angul 61 km. There are frequent bus services in this route. To reach Angul directly, avail Dhauli Exp. from Howrah at 6-15 hr, get down at Cuttack at 12-55 hr and from there by bus. From Babughat of Kolkata private bus goes to Angul leaving at 17-00 hr. Distance is 606 km. From Angul you may go Satkosia Wild Life Sanctuary or Tikarpara by bus. 2 morning canter (Mini Bus) service and at noon ORTC Bus at 14-00 hr and goes along NH 42 via Badakera (12 km) and taking a left turn from there crossing Pampasar Check Post (13 km) further 30 km. Half a km from Bus Stand there is Tikarpara/ Satkosia Gorge FRH. Electricity and Water are available. Gharial Research and Conservation

Unit is on the left of Rest House on the bank of Mahanadi. Crocodile, gharial take sun bath on the bank. Tourist would have arrange jeep themselves to reach Watch Tower (10 km) to take a close look of wild animals. A sweet water pond is there where animals gather in the afternoon (16-00–18-30 hr) to drink water.

On the bus route before 10 km of Tikarpara *Puranakot FRH* is located on a low hill. Though there is electricity, but water in scarcity. Shops are more than half km away from Rest House, *Baghmundi FRH*, 9 km to the right of *Puranakot FRH* is sourrounded by hills in 3 side. Tigers are visible at **Baghmundi**. *Tulka FRH*, 13 km left from Puranakot, is another beautiful place for accommodation. The **Bhimgala falls** is nearby. It drops from a height of 100 ft. It is also a good picnic spot. But, *Labangi FRH* is the best attractive place in the forest. It is to the left of Pampasar Check Post, water is in scarcity. The rest house is surrounded by hills and a superb natural beauty exists all around. Tigers, elephants, bison, deer are found. Variety of unknown flowers add *Labangi's* beauty. *Raigara FRH*, 14 km from *Labangi* and *Pampasar FRH* near check post are also there. There is electricity and drinking water facility.

In every FRH, there are doubled-bed rooms with attached bath Rent at Tikarpara 60, Puranakot, Pampasar, Electricity has reached there. You have to collect ration from Angul. Chowkidar of FRH will cook your food and you will get fuel and utencils in these FRH. Their booking : DFO, Angul Division, Angul, Odisha. Buses and Canter Minibus go to first 3 FRH; but for rest 4 FRH, Jeep is a must. The forest is difficult to access and Labangi is more difficult. If you can arrange a guide you may trek 37 km from Pampasar along *Dandibat* or mountain road to reach Labangi.

Angul : Without booking FRH a night stay at Angul is a must. From Angul, Labangi is 36 km, Tikarpara 58, and Cuttack 115 km. Angul is Dist Hq. Stay at Angul and visit Jagannath Temple, 6 km away NALCO Smelter Plant, 10 km away NALCO CPP. If you do not get RH Booking, hire a jeep and cover Satkoshia Gorge in a day. It takes ₹ 1000 for jeep, for a night halt ₹ 1500 and for 2 nights ₹ 3000.

There are hotels in Angul-759122, STD 06764, *H Shanti*, opp bus Stand, DAB 450 500. A/c 1500. *H Gautam Bihar*, Shanti Bazar, DAB 500-700; *H Sandhya*. NH 42, DAB 500 A/c 1500; *H Raj* Cuttack Road, *H Prasanti*, DAB 600-1750.

Dhabaleswar : Taking a bus to Aatpur from the Cuttack-Badambadi bus stand along NH 5, covering a distance of 12 km, upto Chaudwar and another 15 km by road, will take one to Mancheswar on the bank of Mahanadi. Ferry ghat is half km away from bus stand. On the opp bank there is the island Dhabaleswar. Hire a boat to reach there. Temple is above the ghat and Panthasala is at the bottom. Again, one may avail city bus from bus stand and reaching Biranasi, get an auto to Dhabaleswar ghat and cross the river by boat. *Dhabaleswar Panthasala* is half km on this route. From Barbati Chahatta ghat is to the west. One may cross the river from this place also. Bus and auto services are frequent, Auto fare Rs. 100-200. Recently a Hanging Bridge has been constructed to connect Dhabaleswar with Mancheswar for the benefit of pilgrims.

In the past Dhabaleswar was the *Kshetra* (pace) of Hari (Vishnu). But its glory has been destroyed by Kalapahar. In course of time, *Sayambhu* (abiogenetic) Shiva has been originated. After that in this unpopulated island the Utkal King built massive Mahakaal Temple in the 10-11th centuries. There are many legends centering a rough mound of stone, the God Shiva. This is supposed to be very alive and potent. At the time of *Kartik Poornima* (full moon at a particular season), during *Troyodashi* (a particular moment calculated according to the lunar calendar) a 5 day long *Panchakyatra Festival* is observed and travellers come from far distance places. Accommodation at 16 bedded *Panthasala* of the OTDC, DAB 300-500 Dormi 100; vegetarian dish is available at canteen. AB : ATO, Panthasala-Dhabaleswar, PO-Mancheswar, via-Chasapada, Dist-Cuttack, PC, 754027, Ph. : (06723)20264.

Dhenkanal : It is 52 km by bus from Mancheswar Market (Athagarh 20, Khuntuni 14, Dhenkanal 18). Avail Passenger Trekker instead of bus to reach Dhenkanal, Trekker is available all the time. From Cuttack bus Stand (Badambari) avail Sambalpur, Talcher, Angul or Dhenkanal bound bus to reach Dhenkanal in 1.5 hrs. Cuttack-Dhenkanal Talcher-Angul rail way can be availed. In Dhenkanal the Dist Hq. there is Balaram temple and other old beautiful temples, king's Mansion on a low hill and Science park. Hotels are available at Dhenkanal-759001, STD 06762-*H Surya*, Jagannath Road, DAB 450 A/c 1200-1500; *H Sakuntala*, Dakshinakali Road, D 400 A/c 1200-1500; *H Sreekrishna*, *H Biswanath*, *H Chandrasekhar* and others.

Kapilas : It is 17 km to the N-East of Dhenkanal. To reach here you have to take bus/trekker or jeep/taxi which goes Deonagar from Dhenkanal. It is a holy pilgrim centre of Lord Shiva and is also famous for a health resort. Kapilas is at the foothills of mountain and a lonely place. There is also a zoo (Tuesday closed) towards temple, Gharial Breeding Centre, a lake with boating facility, science park–all are in a row. Various models of science attract the tourist in the science park. Singing of birds of different species throughout the day, clear moon light, calm atmosphere, these are the reasons which attract travellers. Still there is a derth of diversity.

Hiring a jeep for 500-1500 you may start your journey to visit Shiva temple along Easternghat Mountain. It is a journey of 5 km and the temple is at a height of 457 m. The temple was built in Odiya architecture. You may reach temple on foot climbing 1365 steps and covering 2 km. On the way, colourful butterflies, monkeys will accompany you. Banyan tree, Kendu, Mahul, Amlaki, Bahera etc. are found. There is also a spring, bathing in which cures diseases. There are many other gods in other temples located nearby. Tourists feel disgusted by the priests. During *Shivaratri* a fair is held. Climbing mountain you may enjoy the heavenly beauty of the spot and visit a Vishnu temple.

Only half km from bus stand towards temple, Odisha Tourisms *Panthasala*, Kapilas, DAB 400-500 Dormi 100 AB : Asst Tourist Officer, Panthasala, PO-Kunjakanta, Dist-Dhenkanal, PC-756011. On the mountain PWD'S RH.AB : PWD, Dhenkanal and Mandir Committee's *Guest House* (without bed), Deogaon village is half km from Panthanivas.

Joranda : On Kapilas-Dhenkanal route, 9 km from Kapilas and 8 km to the N-East of Dhenkanal is Kaimati and to the left from there is Joranda at a distance of 10 km. Bus and Trekker ply from Dhenkanal to Joranda. In Joranda there is *Kaupin Dhari Mahima Samaj Mahima Gadi* which was founded in 1826. Mahima Swami was buried here. It has a wide and vast area. Their organisation is also large. On *Maghi Purnima* saints and sages gather at this place.

Dandadhar : Kamakshyanagar, a small suburban town is located 36 km from Dhenkanal. It is a calm and quiet place. A little hill range covered with dense forest– its name is Budha Pahar (Mountain). Dandadhar is located 26 km from Budha Pahar, crossing Budihil village and further 2 km away where a dam has been built on Ramial river. A lake has been made. Wild animals are seen in the evening. A temple has also been built near dam. Lord Shiva is the deity. Only accommodation is at *IB*, AB : EE, Angul Irrigation Division, PO and Dist-Angul, Odisha. In Kamakshyanagar there is also a *IB*. AB : same as above. *FIB* is also there. Though bus and trekker are available but it would be wise to keep Jeep all the time. Food is to be arranged personally.

Shaptasajya : 12 km to the S-West of Dhenkanal, in a forested, mountainous region-where the *Saptarishi* (7 holy men) used to pray is **Saptasajya** i.e. 7 caves and 7 streams in 7 mountains. 7 Rishis or holy men have been immortalized here. There is also Raghunath temple in the mountain. While in exile in the forest, Ramachandra (a God of Hindu mythology) stayed for 7 days in this region. There are images of Ram-Sita-Lakshman. At the time of *Ramnawami* (Hindu festival) a colourful and boisterous celebrations is held for 3 days. One may get Annaprasad. Jeep and taxis ply from Dhenkanal. Before 1 km one has to climb 100 steps to reach the temple. Jatannagar is 16 km from Saptasajya. On the hillock there is a palace which is now in dilapilated condition.

Ansupa : At a distance of 70 km from Cuttack the small, unknown Ansupa has become famous for its natural lake. In the shade of bamboo and mango trees beauteous nature seems to have painted an even more beautiful picture in Ansupa. A long distance away, the Saranda mountain range seems to have built a natural barrier. In winter, the attraction for this place increases as variety of known and unknown birds come to make their habitat in the lake. There are no accommodation at Ansupa. It would be best to avail 8-08 hr Puri-Rourkela Passenger any morning, and after getting down at Rajatgarh at 9-28 hr and from there 20 km bus journey to Ansupa. From Dhenkanal too buses or taxis are available. At the end of the day one can return to Cuttack by train.

The Wonder Triangle : One may make a trip to pay a visit to the heart of Buddhist culture, the Wonder Triangle-**Lalitgiri, Udayagiri** and **Ratnagiri** by bus or car from Cuttack at a distance of 62 km to the N-East. 7th century Chinese traveller Hieun Tsang in his book described about 100 Sangharam where 10000 monks were engaged in religious mission. It is assumed that those were situated in todays wonder triangle on Pushpagiri mountain. This trio of Birupa-Chitrotpala probably the oldest in its kind.

Lalitgiri : When excavations were being carried out in Lalitgiri in 1985-92, articles of 2 century BC (at the time of the Sung dynasty) were found. Among them was a massive monastery made of bricks with beautiful engravings and etchings on it. Along with numerous articles of gold and silver a stone made container also found where hair and other remnants of the Buddha were kept. In earthern pots, traces of the Kushana dynasty and Brahmi script are also found. Excavations have also unearthed a temple with bow-shaped arches, 4 monasteries and a massive stupa. A reflection of the *Temple Culture* in Java and South East Asia are found here. There is an uniqueness in the massive image of Buddha–pursed lips, long ears and face and a wide forehead are to be noted. A museum has also been set up with the articles found in the excavations.

Udayagiri : It is located 24 km from Lalitgiri and was the centre of Buddhist religion based on Tantra. Kimiriya River flows through Udayagiri and Ratnagiri. Though it was built after Lalitgiri but, the Buddhist religion spread in India and abroad from Udayagiri. We find from the writings of the Buddhist tantra, that in the 6th century, a 3 m high image of Lokeswar Buddha– which was built in a particular form *Bhumisparsha Mudra* (touching the earth) with a lotus in his hand. A 8th century script has also been found in the image. Saharapada, came from Nalanda to Udayagiri, being greatly attracted by the Vajrayana Centre in 7th century. Saharapada also became the first *Guru* (spiritual guide) of the Tantra School of Thought. For the travellers/tourists a replica is being built. There is also a 2000 year old *Bamphi* i.e. well. Even today, the water of this well quenches the thirst of the locals. According to popular belief water from this well offers a cure from any sickness.

Ratnagiri : Ratnagiri is located 10 km from Udyagiri and it was built by the Gupta dynasty kings. In 1970, behind the bazar in the village adjoining Ratnagiri, excavations also revealed a beautiful stupa at the peak of the mountain, below the stupa a beautiful artistic quadrangular 2 monasteries of the 7th century, 8 temples, the residential complex of monks and other. There are also 300 Gods and Goddesses of Buddhist Tantrik religion. Bronze and stone images of the Buddha have also been found. There is a massive image of the meditating Buddha at the peak of the mountain whose eyes are half opened. Ratnagiri, which was developed between 5th and the 12th century was the centre of Buddhist philosophy till 16th century. A museum has also been set up with the articles found in Ratnagiri. Huen Tsang (639 AD) described Puspagiri University which was in Ratnagiri. Till today new articles are also being found in Lalitgiri, Udayagiri and Ratnagiri.

From Cuttack along the NH 5A if one goes Choudwar (5 km), Chandikhol (44 km from Cuttack) and then towards Paradeep (10 km from Chandikhol) and turn left, Ratnagiri is 22 km away from that place. Private bus go to Ratnagiri in 3hr leaving 9-00, 12-00 and 15-00 hr. On bus route Udayagiri is 10 km before Ratnagiri. And from Udayagiri returning at NH 5A (12 km) if you go towards Kendrapada (10 km) and then 2 km along the road where a tower stands, there is Lalitgiri. From Cuttack it is 62 km and Paradeep 64 km. Though Ratnagiri and Udayagiri may be visited in a day by bus, but due to connecting buses visit to Lalitgiri in a day is quite impossible. However, if the tourist do not have a personal car, he/she may hire a car for ₹ 4000 and visit the trio in 7 hrs journey. And while returning one may have a look to Jagannath Temple of Chattiya. Reaching Chandikhol by any bus one may hire a trekker for ₹1500 and visit the trio. In this arrangement one may save money.

Accommodation at the OTDC's *Panthasala*, Ratnagiri. Food is also available under the supervision of the warden. Booking : Tourist Officer, Odisha Tourism, Cuttack. However, it is advisable to avoid staying overnight and instead take a bus to return to Jajpur.

Paradeep : The enthusiast could also visit the port of Paradeep at the face of Mahanadi, 83 km from Cuttack. Trains leave Cuttack at 19.00 and reach Paradeep at 21.45 hr; return at 6.00 from Paradeep. One can go by rickshaw to the Badambari bus stand, 3 km from the Cuttack rail station, where in every half an hour express and non-stop service buses ply to Paradeep. The 1st leaves at 5-00 hr and the last at 20-00 hr from Cuttack; further, the 1st one leaves Paradeep at 4-30 hr. and the last at 18-45 hr, return to Cuttack. It is a journey of about 3 hrs.

Paradeep, left to the bus-stand, adjoining the bazar one can find *H Aristocrat*. At the rear of the Aristocrat, at a distance of half km *H Paradeep International*; 1 km from the bus stand, towards the sea *H Golden Anchor*. Further, about 1 km from the bus-stand one can also find, *Circuit House*, AB : ADM, Paradeep; at a distance of 15 km from the bus stand there is the Nehru Bungalow i.e. the *Jawahar GH* Port Trust, AB : Chairman, Port Trust, Paradeep-745142. The position of the Circuit House is undoubtedly the best. Similarly, the *Paradeep International* offers fairly good arrangements and facilities.

The town of Paradeep has been developed all around the port. The ships which come from different countries of the world wait at the jetty with their anchor down. The port is adjoining the bus stand. The activities of the fishermen can be observed after taking permission from the Administrative Officer at the entrance. The trawlers ply up and down, fish are sold in auction. However, there is no proper beach for bathing. On the tourist map, Paradeep does not have a prominent place. However, there is the Lighthouse, Crocodile Park and Deer Park. A little distance away the Mahanadi meets the sea.

Jajpur Birajakshetra

Jajpur district is one of the important Hindu pilgrim centres. Jajpur is one of 51 piths where navel of Sati fell. As a matter of fact, the navel of Gayasur (a demon) also fell here. Jajatipur was named after King Jajati Kesari. In time it has become Jajpur. It was also the capital in those times. However, in the mythological era, Jajpur of Virajakshetra was famous by the name of Nabhigaya Tirtha.

All trains bound to Bhubaneswar from Calcutta pass via connecting rail station Jajpur-Keonjhar Road Distance of Calcutta is 337 km. Cuttack is another 72 km ahead while the distance from Bhubaneswar is 100 km. Buses ply to Jajpur town, which is 19 km from the bus stand. The ORTC buses also leave at 17-30, from Babughat in Calcutta and reach Jajpur town and finally at Singhpur. One can also avail direct buses to Jajpur town from Cuttack. It is a journey of about 3 hrs.

Ordinary Hotels are available in Jajpur. However, besides the *PWD IB*, most ordinary hotel, the houses of the *Pandas* (religious people engaged in organizing the worship etc.) there are *Dharamasalas*. There is also OTDC's *Biraja Panthasala*, Booking : ATO, Panthasala.

Jajpur, PC - 755001, Ph- (06728) 20029. There is no need to stay at Jajpur. After having a look at Jajpur, one may take a bus and go to Cuttack, Balasore or Keonjhar and spend the night there. On the way, at Bhadrak-756100, one will find the *Rajesh L, Shantiniketan L, Saroj L, Adarsha L-* spending the night there and then to Chandipur by bus via Balasore. One can avail train and bus both from Bhadrak to return Calcutta. It is advisable to visit Bhitarkanika from Bhadrak.

Jajpur town is centred around the temple. The main temple is of Biraja i.e. Durga. In the centre of the temple, on a bejewelled altar, Goddess Biraja or Durga is placed who was created by Brahma; She is on her mount, a lion. Goddess with two hands is portrayed as having a spear in one hand and with the other grasping the demon Mahisasur's tail. Special festivals are held during Durga Puja and Kali Puja (Hindu festivals). A chariot is drawn at the time of Durga puja. There is Nabhikunda, a pool; it is believed that if one takes a dip here and then prays for the spirits of ones deceased forefathers, 7 generations are permitted to enter Heaven. Immediately besides the Biraja Temple is the Brahmakunda. It is believed that this kunda was made at the time of Brahma's *Dashashyamedha Yagna* (a type of very potent religious ceremony).

There is also a temple dedicated to Jagannath in Jajpur. Besides the Neelamadhav, like in Puri, there are all other Gods in the temple. Pandas claim that this is the main Jagannath temple in Odisha. Besides these, there are other temples in Jajpur. Amongst them, Ganapati Temple, on the bank of the Baitarani is noteworthy. There is a massive red image of Ganesa (the Elephant God). In the wall shelf a tiny image of the 10-armed Ravana is of another attraction.

The Matrika Temple in Jajpur is also a place to be appreciated. *Ashtamatrika* is worshipped in a narrow, long, ordinary looking temple. Ashtamatrika i.e. *Chamunda, Barahi, Oindri, Baishnabi, Brahmi, Koumar, Maheswar and Narasinghi.* There are different opinions regarding this Ashtamatrika.

Pandavas came to other players for their ancestors in this island shaped pilgrim centre, surrounded by Baitarani river. This custom of offering are followed even today. Sri Chaitanya Mahaprabhu also came here and that memory is enshrined in *Chaitanya Padapeeth Temple*. There are also temples of Vishnu in disguise of a boar, Bimaladevi, 9 cornered Suryanarayan, Nabagraha and Shuva stambha - cut out of single rock. There is also a banyan tree *Bancha Bat* - which fulfills devotee's wish. In Jajpur there are many Shivalingas (54 + 42 + 12). Colour of Agniswar Shiva changes in every 3 hrs. Similarly, Tileswar Shiva Temple, where, it is believed that the images of Shiva is increasing day by day. You may visit Jajpur town on foot or by rickshaw. From Jajpur you will get several buses going up to Singpur. At Singpur cross the river Kharasrota, you will reach another historical place GOVINDAPUR KUTCHERY. There you will visit the enchanting and oldest Chandrasekhar Temple, where a mela was organised at the time of Sivaratri. Just after a few yards, a traveller will enjoy Basanti Devi Sakti Pitha where every year Basanti Devi puja was celebrated with pomp and ceremony. The tradition has been kept alive by the enthusiastic descendants of the Bose family, (former-Zamidar of the place). The scenic beauty of this quiet village is inexplicable.

Tourist arrival by motor lunch and Dangmal

Bhitarkanika :

The world of nature is full of wonders - sometimes tender, sometimes awe inspiring but all the time exciting. Some of them defy description and transcend perception. Such a land of rare and unmatched beauty is Bhitarkanika - a wonder in the wild.

Widely acclaimed for its biodiversity in flora and fauna, it is the second largest compact mangrove ecosystem in India. It is also a Sanctuary and National Park. Extending over more than six hundred square kilometers, it is one of the very few evergreen repository of most luxuriant mangrove vegetation in the world. More than sixty varieties of mangrove plant are found here which provide home to a variety of rare and endangered species. The pneumatophores, better known as breathing roots, stand like sentries of land.

Bounded by rivers on three sides and the sea on the fourth, Bhitarkanika is criss-crossed by numerous creeks and canals which finally meet the sea and make the estuarine delta, the playground of the Bay of Bengal. When the tide enters, the forest floats and the water kisses the foliage. As it recedes, the multi layer mud flats on the banks of the creeks expose their bosom with fiddler crabs, mud skipper fish and little reptiles. It is a sight to watch.

This deltaic region comprises a couple of tiny islands formed by the meandering creeks. With Dangamal at the centre stage (the others being Ekakula, Habalikhati etc), Bhitarkanika is a natural habitat of a lot of wild creatures like Crocodiles, King Cobra, Pythons, Wild Pigs, Rhesus Monkey, Sambars, Spotted Deer etc. There is a Crocodile Breeding Farm at Dangmal. The pride possession of this Farm is the White Crocodile Sankhua, a rare species in the World.

Over 170 species of resident and migratory birds of different hue enhance the beauty of the wild. Prominent among them are King Fisher, Open billed Storks, Sea Eagles, Kites, Sand Pipers, Darters, Whistling Teals, Sea Gulls, etc. The chirping of birds nesting at Baga Gahana is sure to leave an indelible impression in anybody's mind. Watching the wildlife in their natural habitat while cruising through the creeks is a thrilling experience. A trek on the laid out routes will also be equally rewarding.

Another amazing phenomenon of nature here is the visit of Olive Ridley Sea Turtles to Gahirmatha in lakhs twice every year between January and March to lay eggs enmasse.

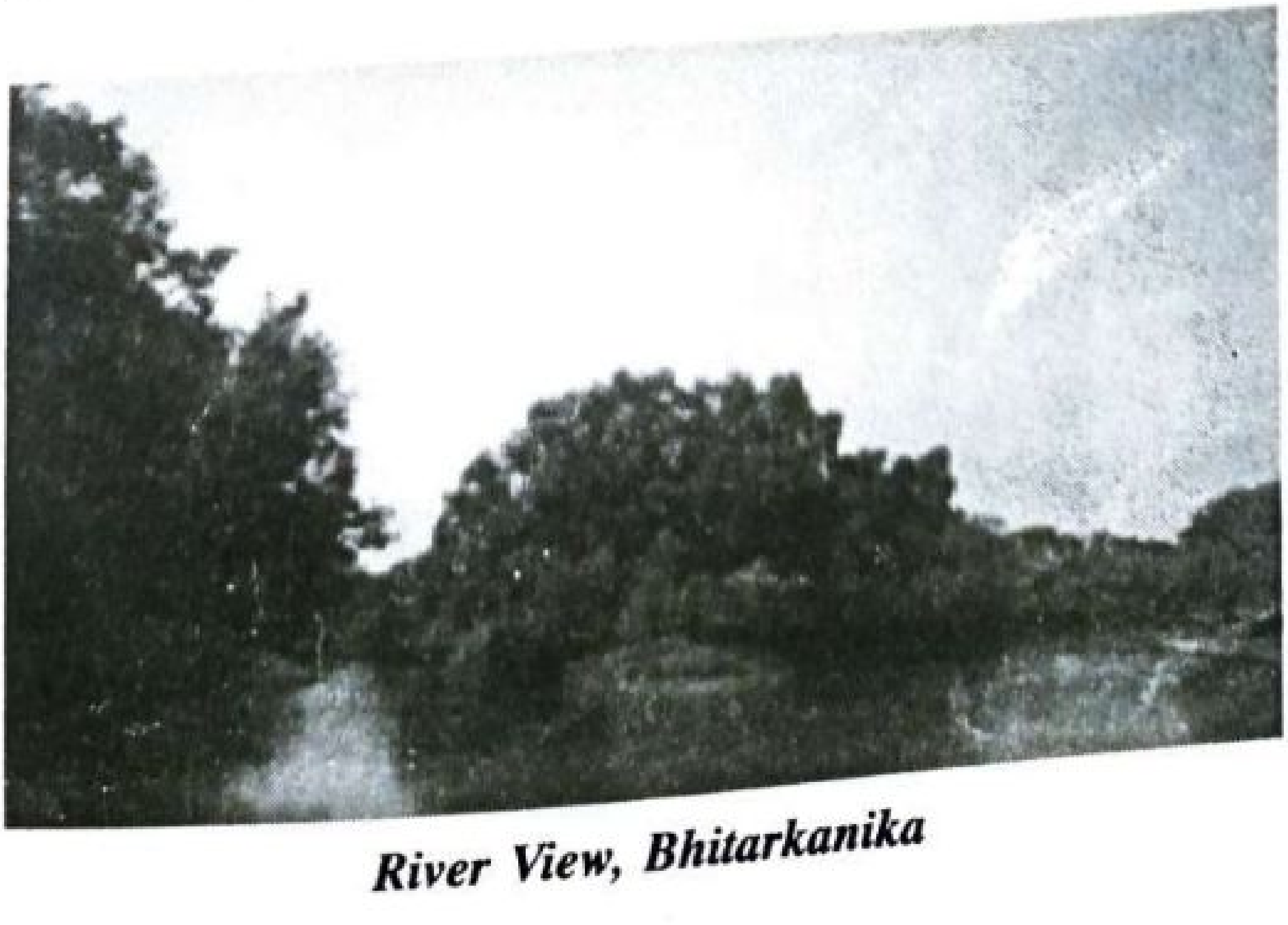
An unexpected additional attraction is the remains of two 9th century monument-a temple dedicated to the worship of Lord Shiva and the other, a Shakti Shrine at Dangmal.

Away from the blinding lights and deafening sound, Bhitarakanika is a different world altogether, a real retreat in the lap of nature. Once in here, the world outside will virtually disappear. Back in work place, the memory will haunt like a fairy tale.

Entry Points :

Permission to visit Bhitarakanika can be obtained from Divisional Forest Officer, Rajnagar, PIN : 754225, ph : (06729)272460 of Assistant Conservator of Forests, Chandbali, Pin : 756133, Ph : (06786) 20372 on payment of prescribed fees.

Best season to visit - October to June.



River View, Bhitarkanika

in Janug *Kalinga, Swarnachuda, Hemangini* and *Suraj* get priority.

Balasore :

The tourist attraction of this place is undeniable. One can avail of the bus/auto/rickshaw to visit Chasakhand. If one takes the road leading Balasore, along NH 5, One will reach Phulari 8 km to the north, and on the left-hand side, on the Baghajatin Road, if one progresses further 2 km. is Chasakhand. A statue of Bagha Jatin has also been made 3 km to the north of Chasakhand. Buses ply every other minute on OT Road. There is also the *Khirchora* (cream stealer) *Gopinath* Temple at **Remuna** which is a Vaishnav Pilgrim Centre and Vrindavan of Odisha. From Balasore it is 6 km. Legend says that the incarnation of Lord Krishna, Gopinath, used to live here 800 yrs ago. However, the temple is 150 yrs old. One can avail auto and rickshaw to make a trip here and purchase Khir Bhog. The newly built Jagannath temple by Emami is worth visiting place and PRASAD is also available. The distance is only 500m from Gopinath Temple, Remuna at Balagopalpur.

Panchalingeswar :

From Balasore one can take a bus at 8-00, 13-00, 16-00 and for a 1.5 hrs journey to Panchalingeswar. After crossing 1.5 km from bus road, a low mountain stands like a barrier all round. There are deep forest, thick wood, and a variety of animals inhabit in the Nilagiri mountains. At the foothill of the mountain, OTDC's has a roomed *Panthasala Panchalingeswar,* 4 beeded room 500, AB : ATO, PO-Shyamsundarpur, Via-Raj Nilagiri, Balasore - 756040, Ph - (06782) 273005. From the windows of the Panthasala one can see herds of elephants, moving through the forest trampling down trees and stepping over boulders. There are bears in a graceful movement. Sometimes, it will not be unnatural if you see tigers in the Nilagiri Mountains. The blue mountains and the blue horizon seems to merge into each other at Panchalingeswar.

A little distance from the Panthasala, the road leads upward. There are more than 200 steps crossing which one has to move further 1.5 km to reach the altar of the God. There is no temple. A cascade descends with melodious note from the hill and the water is collected below. If you dip your hands in the water, you will touch 5 Gods, Panchalingeswar or 5 Shivalingas. It is believed that the deity is very powerful. Jarasandha is said to have worshipped this Panchalingeswar. Panthasala at Panchalingeswar is an ideal place where you can spend a short trip in sweet solitude. Meals are also available here. Opposite, there are shops where you may get meal against advance order.

You may visit this place coming by a bus in the morning and return by bus in the afternoon. From Balasore avail any bus which goes to Nilagiri (14 km) and from there get a rickshaw of ₹ 30-50 or for another 6 km to reach here. Buses to Nilagiri are available in every hr. Seasonal tourists during the tourist season, may avail conducted tours from Chandipur or avail of auto/taxi from Balasore for ₹ 650-950 and visit Panchalingeswar / Chasakhand / Remuna in 7/8 hrs; one can also avail rickshaw for ₹ 80 and visit Chasakhand/Remuna etc in 5 hrs.

120 km from Balasore to the south there is the port city of the past, Chandabali, 14 km to the south via Shergarh. If one turns the right and move further 27 km there is Ayodhya, where ruins of Buddhist and Jain temples are found. Some mother images of 10th century are also found. ORT buses ply from all directions around the state from Balasore.

Kuldiha Forest :

10 km from Balasore to Shergarh and then leaving the NH, to the right, move further 4 km to Nilagiri, then take the left-hand road, leaving behind Panchalingeswar another 7 km to Sujangarh. Here, if one takes another left turn, one will reach Kuldiha Sanctuary covering 11 km. At a height of 91 m and spreading out over an area of 282 sq km, there is a dense forest where Sal, Piyasal, Sishu, Mahaneem, Mango, Neem, Bahera can be seen. In Kuldiha Forest wild elephants, leopard, the long tailed baboon and other animals are also found in varieties. There is also a Lion Sanctuary here. For accommodation *Forest Bungalow* is the only place. Booking : Range Officer, Sujangarh, via - Nilagiri, Balasore or DFO, Baripada. Food arrangements have to be made personally. Though bus services are available from Balasore to Sujangarh, the last 11 km is to be covered by jeep. Enthusiasts can take a guide and track along the mountain.

(TABLE - 12)

Number of Foreign Tourist Arrival

Odisha and All India (2004 to 2015)

Year	India	Odisha	Odisha's share (%)
2004	3457477	28817	0.83
2005	3918610	33310	0.85
2006	4447167	39141	0.88
2007	5081504	41880	0.82
2008	5282603	43966	0.83
2009	5167699	45684	0.89
2010	5775692	50432	0.87
2011	6309222	60722	0.96
2012	6577745	64719	0.97
2013	6967601	66675	0.96
2014	7679099	71426	0.93
2015	8027133	66971	0.83

Source : Department of Tourism, Government of Odisha.

Devkund :

It is a part of Udala division of Similipal Forest via Nilagiri/Udala from Panchalingeswar. From Lulung, the distance is 90 km. and from Devkund Kuldiha is 69 km and Balasore 87 km. Regular bus services are available from Balasore to Udala (59 km). If you take a jeep from Udala to Devkund, the distance is 28 km. Last 5 km is a dense forest. Forest is surrounded by mountain. There is a waterfalls, which drops from 50 ft, lake is created by the falls which is Devkund. There are 4 other lakes, for which it is named *Panchakunda*, or Place of Five lakes. Climbing up more than 100 steps from Devkund, at the source of the river, there is a temple dedicated to Devi Ambika Mata (Durga temple) which is worth seeing. The temple was built by the kings of Mayurbhanja, worship is carried on even today. Along with innumerable known and unknown birds, there are also a variety of multi-coloured butterflies which is also attractive. However, since the road is difficult to access, Devkund remains unimportant on the tourist map. There is no accommodation for night halt.

Keonjhar :

The name of the rail station is Jajpur-Keonjhar Road From the rail station buses go to Keonjhar at a distance of 112 km. Besides Bhubaneswar (225 km), buses come from various directions throughout the state. Tourists to Similipal are advised to go to Khiching first by bus and then to Keonjhar. One can also take the opportunity to go by bus to Kiriburu/ Meghatuburu in Bihar from Barbil-Keonjhar.

Accommodation : In *Keonjhar -758001-H Plaza,* NH-6, New Market, DAB 200-400, *Gayatri GH,* DAB 400; *H.Mayur,* DAB 400-700; *Keonjhar L,* DAB 400-650; *H Boral,* DAB 400-600 ; *Labanya Bhawan L,* DAB 400-600. Besides these, between 100-125, for a double bedded room, one can go to *H Ajanta, Chowda L, Mini L, Parijat L, Baba L:* and there is also the *Circuit House,* AB : Collector; *PWD IB,* AB : EE ; and also *Arya Samaj Dharmasala.*

Keonjhar is a small, quiet, tranquil little town surrounded by forests and mountains. There are many other tribals besides *Santhals, Oraon* and *Mundas.* At a height of 1575 ft with a lilting notes of numerous known and unknown birds a virtual heaven on earth exists there. Either on foot or by rickshaw, one may visit the Jagannath Temple about 3 km from the city. There are numerous other Gods in the temple premises. The temple remains closed in the afternoon between 12-00 and 17-30 hr. One can hire a jeep or rickshaw to go 5 km trip from the city, where the *Sanghaghra* (little falls) comes down from a height of 100 ft and a 10 km trip to the *Badaghaghra* or Big Waterfall which comes down from a height of 200 ft. This 2 waterfalls are truly beautiful and supply drinking water of the city. It is an ideal place for picnic.

Source of the river Baitarani in Guptaganga of the Gonashika Mountains, distance is 30 km. It is like a nose of a cow. There is also a temple dedicated to Brahmeswar Mahadev. From a fall Baitarani touches the earth and disappears after few meters. It is visible again in a kunda as Guptaganga in Gonashika village. Covering 400 km the river meets the sea, keeping Jajpur by the side. Another opinion is, the source of the river is Malaygiri hills. To reach Gonashika you have to avail Pallahara/Sambalpur bus (21 km) and a walk of 9 km from there Jeeps ply directly to the mountain. About 16 km from Keonjhar is Gandhamardhan. In the epic of Ramayana, Pavanputra (son of the Wind God) lifted Gandhamardhan Mountain of his head and brought it to Lanka i.e. Srilanka. To reach **Sitabinji**, one will have to take the route towards Jajpur and after covering 23 km at Katarbeda and from there another 7 km to the right. There are frescoes on the mountains, shaped likc a half open umbrella. Local legend says that this is *Rabanchaya* (shadow of the demon Ravan). There are other mountains scattered around namely Lava, Kusha, Ravana Chaya. There is also a ashram of great saint Valmiki, the birth place of Lava and Kusha i.e. the place where Sita devi gave birth to them. Far below flows the river Sita. Natural scenery in Keonjhar is also very beautiful. On the Keonjhar-Jajpur-Anandapur NH11, **GHATAGAON** (45 km), one may visit **MAA TARINI'S PLACE,** on the bus route from Keonjhar to Anandapur. The Goddess is worshipped here at the base of a tree and is believed to be extremely potent. Coconuts are despatched from all parts of Odisha.

Karanjia is 24 km from Keonjhar. From Karanjia avail Anandapur bound bus and reach Mourijoal (10 km). A trek for farther 10 km will take you to the place where the river Baitarani jumps on bolders from a height of 150 ft and flows through a ravine. Another half km journey along mountain there is **Bhimkunda,** 260 ft deep and is filled with light green coloured water. Heresay, Baitarani disappears under Bhim Kunda. But disappearing into a crevice it is again visible at a distance of 3 km. from Bhimkunda. Elephants and bears are common animals in this forest. They appear particularly at night. There is also a Shiva temple, near to bungalow. You may accommodate yourself at the 2 roomed bungalow of Irrigation Department. For accommodation, ordinary hotels and *PWD Bungalow* at Karanjia. Khiching and Bhimkunda are located opposite to each other.

Similipal :

At the crossing of NH 5 and NH 6 as you pass Bangriposi. NH 6 follows mountain road. Temple of forest goddess Bangriposi is at the mountain. Usually, car drivers stop here and offer prayers to the goddess. Legend is that if any driver of a car disrespect this goddess by crossing the temple without offering puja, his vehicle will certainly be out of order. But if he realises his fault and offer puja, the vehicle will start moving almost immediately. From Bangriposi if one goes on to Talaband or progresses along NH 6 for 61 km, one reaches Joshipur-that is the gateway to the **Similipal National Park.** To the west of the park is Joshipur, to the east Baripada, another entrance of National Park, Pithabatta is via this way.

In the past, it was the hunting ground for emperors. Area of which is 2750 sq km. In 1957, this area was developed as a national park. The core area is of 845 sq km. Mountain made of granite, deep forest-all in a very appealing surroundings. Similipal is the largest in area and one of the most beautiful national parks of India. The Mahanadi flows through the valley. To the north and the west is the NH 6. In 1972, the title of National Park was given to Similipal. In 1983, taking 117 sq kms of the total core area, a **Tiger Project** was started. According to *Sumari* (counting) of 2001, there are 99 tigers, 21 Leopards, 18 cubs are in Similipal. Its height is between 757m-946m and it is in Easternghat mountain.

It is to the N-East of the state, to the west of Baripada, surrounded by trees of Kendu, Masua, Kadam, Champa and Sal etc. Similipal is a National Park in lush green. During Spring-lilies, nageswars, orchids make Similipal an enchanted place. Here, one can see 501 varieties of creepers and plants. 102 variety of trees and 82 variety of orchids. There are 231 variety of birds also. Among the inhabitants of Similipal there are peacock, tiger, wolf, 4 horned antelope, deer, panther, sambar, cheetal, elephant, hyna, bear, fox, nilgai and leopard more than a hundred in numbers. The Meghasoni Peak is located 91km away, at a height of 946 m, it can be visited. This is a very favourite spot of all tourists. From Joshipur Bazar towards Keonjhar, it is 3 km, one has to get permission from the Assistant Conservator of Forests, Similipal National Park, Dist - Mayurbhanj, Joshipur-757002, Ph-(06792) 252593 to enter the forest. Foreigners need permit to visit core area. The season for visiting is from Nov 1st to June 15th. The temperature is between 45° to 50°C. From June-Sept it is Monsoon. The average rainfall is 2000 mm. One also has to pay a fee to stay in the forest-for Indians it is ₹ 40 to 60 a day and students have a 50% discount. Entry fee for a foreign tourist is ₹1000. A change is also levied for cars and cameras depending upon the standard. One should take Malaria prevention doses before entering to Similipal.

In Package tour, wild animals, waterfalls, flower covered valley towering mountain peaks, ice caves and others beauties of Similipal are included. 200 km journey in Similipal in a 4 seater luxury bus for one day one night tour including caveyance, accommodation and meal, ₹ 1500-2500 is required per head basis. If there are sufficient number of tourists (16) then leaving at 8-00 hr in the morning, it returns at 20-00 hr to Joshipur in a 25 seater luxury bus, the charge per person is ₹ 200. Food is also available on advance order. Booking : Deputy Project Manager, R and D (Tourism), Similipahar Forest Development Corporation Ltd., Joshipur, Dist - Mayurbhanj - 757034.

The Odisha Govt's ORT buses leave Calcutta from Babughat at 5-30 and reach Joshipur at 12-45 via Keonjhar/Barbil. They return from Barbil leaving at 17-00 via Keonjhar and reach Joshipur at 22-00 and next day morning to Calcutta at 8-00. Private buses also ply from Howrah Bridge on Mondays, Wednesdays and Fridays leaving at 19-00 (an overnight journey) via Joshipur, Karanjia and Keonjhar. One could also take the train from Howrah and reaching Balasore go by road to Baripada or Joshipur. The distance between Balasore and Joshipur is 120 km. From Joshipur to Bhubaneswar 323, Keonjhar 70, Badampahar 17, Tatanagar 104 km. The distance between Calcutta and Similipal is 291 km.

One can stay at the *Forest Rest House* and *Cottage* at the Similipal National Park. At the Chahala, 40 km from Joshipur a 4 bedded suite is ₹ 1000-1500; in the *Eucalyptus Villa*, 44 km away, a 4 bedded suite ₹1000-1500; in *Camp House*, Kairakacha located 44 km away there is a 2 bedded room and suite. In *Falview RH*, at a distance of 56 km, a 2 bedded suite ₹ 600; in Nawana, 63 km away– a 2 bedded suite ₹ 400-600; in *Falview Retreat*, Joranda, 71 km away, a 4 bedded room for 600, in *Log RH*, Jenabil, 62 km away, a 2 bedded suite; in *Uppebrarakamra RH*, 80 km away, besides the bed, a 3 bedded room. At these places, though utensils are available, food arrangements have to be made personally. This is generally collected from Joshipur. 50% of the room tariff has to be sent by bank draft on SBI in favour of Field Director, Similipal Tiger Reserve, Baripada. This draft should be sent along with a letter to Baripada - 757002, Odisha, Ph- (06792) 252593. Further, for *Gurguria FRH* (28 km) away and in *Bhanjabasa FRH* (95 km) and *Dhudruchampa FRH* (85 km)- the booking has to be done through the Deputy Gen Manager, Similipal Forest Dev Corporation Ltd., Baripada -2. The travel arrangements have to be made by the individual. One may also visit Similipal from Baripada and return there at the end of the day. Jeeps are available for ₹ 2800-4800 to visit Similipal and return. On way to Similipal from Baripada 8 km to the north is **Kuchai**, and at a distance of 17 km **Kuliana** where the excavations unfolded many unknown of the past.

One can also visit the National Park from **Joshipur.** About a dozen private jeeps are available on rent. The charges are ₹ 30 per km, to stay overnight another ₹ 100 is needed. Visit to the park can be completed in Journey of 200-250 km. You may hire a jeep for ₹ 1800-3800 and return Joshipur on the same day. You can enter the park from dawn to 14-00 hr. But to watch wild life dawn or afternoon is the best time.

To stay overnight, the *Khairi Niwas Forest Rest House,* adjoining Joshipur Conservator's office is quite good. For a 2 bedded suit charge is ₹ 600 and at the end of the bazar, on NH-6, Joshipur - 757034, there is Dr S.Roy's 11 roomed *Tourist Lodge*, DAB 450-650. The NH 6 *Inspection House* is also there in Joshipur bazar. Besides this, 36 km from Joshipur, in Rairampur, there is the *Nishamani L* and the *Saha L.* Similarly, in Bangriposi, between Joshipur and Baripada, various accommodations are available.

From Joshipur bus stand, on the way to the forest office, one may also visit Ramatirtha (2.5 km). According to local legends, while in exile Ramachandra came here; and the foot impressions left are believed to be his. At the time of *Makarsamkranti* (Hindu religious festival), a fair is held here. Adjoining it, the Crocodile Project is another attractive site.

Baripada :

Baripada is the Hq of Mayurbhanj Dist and also the gateway to Similipal. Reservation of FRH is centralised in Baripada. There is also the snow-white Jagannath Temple in Baripada. Baripada is also known for its Chariot *(Rath)*- it might be smaller in size, but as regards historical importance, it ranks immediately after that of the Jagannath Temple of Puri. At the time *Chaitra Samkranti* (April), a 3 day colourful festival is held in Baripada. There is also Museum (in Summer 7-00 — 12-00 and in Winter 10-00 —17-00, except Monday) to the left of the bus stand- to the right, on Baghra Road, there is the OTDC Tourist Office. The Santhal tribe occupy quite a major portion of the *rich in nature* Mayurbhanj. 70% of the inhabitants are Adivasis.

There are various places to stay in, at Baripada. About 3 minutes from the bus stand is the Post Office, adjoining Baripada-757001. STD 06792-*H Bishram*, DAB 400-600; immediately beside it is *H Ambika* DAB 500-800 along withTV A/c 1200-1800. At a distance of 1 km, near the Jagannath Temple, is *H Durga* DAB 400-600 A/c 1200-1800; *H Siddhartha*, D 400. *H Vishnupriya*, Traffic square, DAB 400 A/c D 1200-1800; *H Swagat*, Gandhi Park, DAB 400-600 A/c 1200-1800. There are also some ordinary hotels - *H Ashirvad, H Mayura, Ganesh Bhawan, Apsara L, Kalika L, Binod Bhawan*. Their rates are S 150-200 D 300-400. There are also the *CH, PWD IB* in Baripada. There are numerous hotels too where one can get meat. But *Ambika* gets priority. One may get veg, non-veg and Chinese food in Ambika.

From 4-45 onwards, to 23-20 hr buses ply practically every moment from Baripada to Balasore / Bhadrak / Cuttack and Bhubaneswar. There are buses at half hour intervals, which go via Chandaneswar to Digha (border). There are also buses which leave for Cuttack at 5-00, 5-15, 5-30, 9-30, 13-00, 22-00 and 23-00.

From Baripada the distance of Similipal or Chahala is 83 km, Naoana 60, Barehipani 73, Joranda 64, Gurguria 102, Jenabil 86, Upperbarakamra 105, Meghasani 116, Bhanjabasa 120 and Dudhruchampa 64 km.

Haripur :

It is 16 km to the S-East of Baripada. Rasik Roy Temple which was built in Odiyan architecture is ruined today. But Rani Mahal to the northern side and carvings and sculptors of Darbar hall, to the eastern side are wonderful still today. Radhamohan Temple and Jagannath Temple of 14th century are also beautiful.

Bangriposi :

Being located 230 km from Kolkata, 61 from Baripada and 60 from Joshipur on the NH 6, Bangriposi a calm and tranquil place. Rivers, mountains, dense forests have together built up a dream world here. It is an amazing amalgamation of all the beauty of nature. Surrounding Bangriposi there are various mountain peaks like Bidyabhandar, Patharkushi, Ardheswar and Buraburi etc. They are like barriers around this tiny place. it is the natural habitat of the tribal people. Buribalam flows through the heart of this place. The lilting notes of singing of the birds and the charming, shy smile of the tribals all are like a picture, 4 km on, there is the temple of Banadurga i.e. Devi Bangriposi. This Goddess is placed on the back of an elephant and is very potent. While moving, the blessings of this Goddess are sought both by passengers and drivers. On climbing the mountain in front of the bus stand there is Shiva Temple. Thakurani Hill (2 km), Barsoi (8 km), Kanchinda (13 km) are the spot which attract the tourist. Via Talaband one can visit Similipal from Bangriposi. Six seated jeep is available, to and fro ₹ 4000.

Accommodation in Bangriposi - the OTDC's 4 roomed *Panthasala,* DAB 400 AB : Tourist Officer, Odisha Tourism, Baghra Road, Baripada, Dist - Mayurbhanj, Ph-(06792 252710; the 4 bedded *Mukherjee H,* DAB 400-600; *Similipal Resort*, Bangriposi, Mayurbhanj 757032, DAB 400-600, food is also available in this resort.

Hatibari :

Covering the borders of Bengal, Bihar and Odisha in the beauties of nature, there is Hatibari. There are mountains all around and the atmosphere is very appealing, the Subarnarekha river flows below the place. One may enjoy boating also. The beauty of Hatibari-an area filled with trees like the sal, teak, eucalyptus, akashmani. The sweat singing of known and unknown birds create a musical soiree practically all the time. The Forest Bungalow too is another beauty spot. At the border area there is a checkpost where the shops are crowded and traffic creates chaos all day long. Buses taking the NH-6, route from Kolkata take about 8 hrs to reach Hatibari via Jamshola. From Kolkata, along the NH 6, the distance of Kharagpur is 132 km, Lodhasuli 166, Chichira 184, Jamshola 207 and Bangriposi 230 km. Though there is a checkpost on the Bengal/Bihar border at Chichira, but the checkpost at Jamshola on the Bihar-Odisha border is busy all the time. From Hatibari, if one takes the path along the NH 6, leaving Jamshola behind and move 1 km to the left and then further 3 km, one comes to the *Hatibari Rest House.*

Lulung :

38 km from Baripada, a part of the Similipal Tiger Project is Lulung. Though there is a lack of diversity but Lulung with its canopy of green, amidst the mountains and forests is charming, 7 km inside the forest area. OTDC's 10 roomed *Lulung Aranyanivas,* is at a height of 300 m; DAB 600 Dormi 70. One may get food from the canteen, AB : Tourist Officer, Baghra Road, Baripada, PC -757001., Ph- (06792) 252710. or Asst Tourist Officer, Lulung, Ph- (06792) 253297 or OTDC, 41 Lenin Sarani, Cal-13 Ph. 2260556, partial bookings can be made. Electricity (solar energy) is also available in the bungalows. The river Palpala flows below. It is ideal to spend a week-end or a couple of holidays. If one does not have ones own transport, an Ambassador car may be hired for Rs.2500-4500 in Baripada. If you book in advance, cars are sent to pick up passengers. Permission to enter the forest is to be collected at the gate. At a distance of 3 km from the bungalow is Kalipahar where a snow-white stream jumps down from the mountain. Sitakunda formed by the stream is also extremely charming. If one has his own jeep, can also go to Similipal from Lulung. As one enters the Similipal Tiger Project crossing Pithkota Checkpost, one finds a Private hotel *Palpala Retreat.* They arrange for Nature Camps too.

Khiching :

Visitors to the National Park ought to pay a visit to Khiching which is located 45 km from Joshipur and 27 km from Keonjhar. This was the capital of the Mayurbhanja kings (10th-11th century). Though the same glamour and pride no longer exists today, the **Kitchakeswari Temple,** still attracts the devotees. The temple remains closed between 12-00 – 15-00 hr. The main temple of the 10 the century is ruined today. In 1925, King Purnachandra Bhanjadeo built a temple as an addition to the original temple. There is a novelty in its craftsmanship. This 22 m high temple is made of Chlorite stone. Around this Main temple *(Rajdeul)* many more temples are found. In Khiching among the various Gods and Goddesses-Durga, Chamunda, Nataraj, Shiva, Suryadev, Basudev, Lakulisa and the Meditating Buddha *(Dhyani Buddha),* Abalokiteswar and also images of snake gods and goddess. One should certainly pay a visit to the **museum** in the temple premises. Here, there are relics dating back to the Gandhar era. Except on Mondays, the museum remains open-in Summer, between 7-00 –12-00 noon and in Winter between 10-00 – 17-00 hr. As souvenirs of Khiching one can purchase stone articles made by the locals. Dance lovers may enjoy *Chou* Dance also. Enthusiasts can contact Dist PRO in Baripada. Further, the Nilkantha Temple, made of granite in Kutuitundi is also a place of interest.

One may get the only bus from Joshipur at 8-30 hr and within 2 hrs reach Khiching and return at 12 O' clock by the same bus to Joshipur. One may also return from Khiching at 14-30 hr by bus and move to Keonjhar. Besides these, there are buses via Karanjia to Joshipur-Keonjhar. However, the bus service is not frequent and it is advisable to take one of the two above mentioned bus. It would be easy to visit Khiching from Joshipur or Keonjhar. Buses come to Khiching from Baripada (145 km). The nearest rail station is at a distance of 67 km i.e. Badampahar. Accommodation in Khiching -*PWD IB*, AB : EE, R & B (PWD), Baripada-758028. There is also a *Dharamsala*. Besides these, there is the *Revenue RH*, AB : DM in Sukruli.

Sambalpur :

Sambalpur town is the Dist HQ of Sambalpur. It is located in N-West Odisha at the crossing of NH 42 and NH 6. It was named after *Samlai* or Shyamaleswari Devi founded by the King Balaram Dev. River Mahanadi flows below the town. Budharaja Temple (Shiva temple) is located on the Budharaja hill. A beautiful panoramic view of the town is available from the hill top. In the town there are *Bada* (Big) Jagannath, Brahmapura Gopalji Temple. It is also a famous trade centre. Equally famous are Sambalpur's hand woven cloth, saree, tie and die prints, wooden toys. These can be collected as the mementos of west Odisha tour. Still Sambalpur is famous in the tourist map as a junction station connecting Hirakud. Badrama Sanctuary, Huma and Nrusimhanath. Including Rourkela you can visit Sambalpur in 5 days.

Buses play from Sambalpur to various directions throughout Odisha. These are also over-night, non-stop, Luxury OTDC buses which leave Sambalpur at 22-00 hr and reach Bhubaneswar the next day at 6-00 hr. Tourist should get down at Sambalpur road and from there to town by rickshaw. Bus stand is 1 km from the Sambalpur Rd Stn. Further, one may follow NH 42 to reach Sambalpur via Dhenkanal-Angul.

In VSS Marg, Sambalpur-768001, STD 0663-*H Uphar, H Sujata, Tribeni H,* Besides Ashok Talkies, *H Li-n-ja,* on the opp *Rani L, H Chandramani, H Apsara,* Ph-2521366. Then there are ordinary hotels opp Police station, *Nataraj H, New Bombay L, H Kalinga, Indrapuri L, City Boarding, Sambalpur L, Mahanadi L, and Nanda L;* on the bus stand, besides *Transport L,* there are also various others. There is the *CH, PWD IB, FRH, Marwari Dharamsala.* However at Brook Hill, Sambalpur-768001 in every beautiful surroundings, the OTDC's *Panthanivas,* DAB 500 A/c D 1500-1800 get priority;AB : Manager. The State Tourism Dept also has an office in the Panthanivas. The view of the city from the mountain is also very appealing.

Conducted Tours :

If there are enough passengers, the Panthanivas of the OTDC, (every day besides Sunday) organizes tours between 13-00 — 16-00 to Hirakud; on Sundays, between 7-00 - - 20-00 to Nrusimhnath; on Saturdays, between 19-00—01-00 the Ushakoti Reserve Forest. A variety of cars can be hired from the Tourist Dept.

Pradhanpat :

If one takes NH-6 from Badrama and goes towards Keonjhar, one will reach Deogarh (59 km). The distance to Keonjhar is 138 km, Sambalpur 91 km and Bhubaneswar 418 km. Buses also ply on this route. However, enthusiasts are advised to see the Pradhanpat (a waterfall) and visit Badrama in the night and return to Sambalpur in the early morning. Again, along NH-23, one may reach Rourkela (134 km) from Deogarh by bus. *Adivasis* or tribals live in Deogarh. At the end of the city, on the NH, in quiet and tranquil surroundings, 2 streams falls from the mountain. One generates electricity, other provides water supply. There are many temples in Deogarh. Among them are Gopinath, Jagannath and Gokarneswar. One can also find a number of places to stay in Deogarh e.g. *Basantanivas, Lalita-Basant Guest House,* the *Municipal Tourist Home* and the *PWD IB.*

Hirakud Project :

Hirakud Project a livewire of the state. But everything has been disappeared in the water. To control the river Mahanadi 60 metre high, 4800 metre long dam (longest in the world) has been built, at an expense of 26.74 lacs of rupees. The 746 sq km reservoir or the artificial lake is the largest dam in Asia. In area it is nearly double than Sir Lanka. The dam provides water to the 133000 sq km land. In 1957, the then Prime Minister Jawaharlal Nehru inaugurated this dam. At a distance of 25 km, Chiplima Mahanadi drops from a height of 80 ft and a mini hydel power project has been constructed. There is also a temple of

Ghanteswari. She is the goddess of the fishermen. A transmission line (Hirakud to Rourkela) has also been established at a distance of 36 km from Sambalpur. It is 13 km from Sambalpur city.

Immediately on entering the project colony one will have to take permission from the Security Office to see the project and the Gandhi and Nehru Minars stating the exact number of tourists. The mountain range forms a natural barrier, on the banks of the Mahanadi. In the midst of a gorgeous garden, at the end of the Hirakud, climbing up 80 steps, from the revolving **Gandhi Minar** a picturesque view of the lake enchants one. Similarly, crossing the 5 km dam, on the other side, at Burla there is another mountain peak, **Nehru Minar**. Arrangements to stay over in beautiful surroundings at the mountain peak can also be made in the *Luxury Guest House* of the *Ashok Yatrinivas*, adjoining the Nehru Minar. Their booking : Superintending Engineer, Hirakud Dam Circle, Burla, Sambalpur. However, it is the Gandhi Minar which is more attractive. Cars can reach right upto the Minar. The rays of the ebbing Sun cast a wonderful shade all round. The right time to visit is : March-Oct at 8-00 — 12-00 and 15-00—18-00; Nov.-Feb 6-00 — 17-00. However to get permission, the security dept remains open : March-June 7-00 —11-00 and 15-00—17-00; July-Oct 8-00-12-00 and 15-00—17-00; Nov-Feb 8-00—12-00 and 14-30—16-30. On special permission the Power House can also be seen. Arrangements for boating on the lake can also be organized. It is strictly forbidden to take pictures of the dam. Cameras will have to be deposited at the lock gate. One can also contact the Tourist Officer at Sambalpur to get permission to see the Hirakud Dam. Enthusiasts can also see the Sambalpur Aluminium Factory on the way.

On the Howrah-Mumbai via Nagpur railway, a branch line goes from Jharsuguda to Titlagarh via Sambalpur. It is on this branch line that the Hirakud Station is located, 10 km away from the project. Due to a lack of proper communication, it would be most convenient to start from Sambalpur. Tourists are advised to hire a jeep from Sambalpur for autos to visit Hirakud Dam. Buses also ply from opp of Lakshmi Talkies. If there is a sufficient passengers the OTDC organizes package tours from the Panthanivas to Hirakud.

Badrama Wildlife Sanctuary :

Badrama is located 38 km to the east of Sambalpur, on the Sambalpur-Deogarh NH-6. To make a forest journey one should get permission from the Badrama Forest Range Office (on the NH). A guide and searchlight is required. Opp it, there is a 2 roomed *Forest Bungalow-AB* : DFO, Badrama, Dist, Sambalpur, Odisha. A little distance away there is the gate of the Sanctuary.

Ushakoti :

Ushakoti of the past has now become Badrama. Area of the sanctuary has been also increased with the change of name. It is more than 750 m high covering 370 sq km land. In 1962, it became a sanctuary. In sal tree shaded dense forest of Badrama 14 tigers, more than 700 elephants, black panthers, sambars, bisons, gours, peacocks, wild dogs, wild buffaloes, different species of deers are found. Continuous singing of birds fills the atmosphere of the forest. On the bank of 3 sweet water lake there are 3 watch towers. During scorching heat in summer, wild animals come here to quench their thirst. It is not unlikely to meet a few of them from a car. From the range office distance of the first Pool is 8 km, second one is 14 km and the third one is 36 km. There are ups and downs in the forest road. So, tourists should start from Sambalpur in evening hiring a jeep, carring food. The best season Nov-Jan. If number of passengers increase, OTDC organise a package tour to Badrama from Panthanivas. Buses also ply to Badrama along NH.

Huma :

It is located 32 km to the south of Sambalpur. Huma is renowned as a pilgrim centre for the worshippers of Shiva. There are a cluster of temples which are different from other temples in Odisha. It seems that it is the another version of the Leaning Tower of Pisa one of the 7 wonders of the world. It is unique in the temple architecture of India, each temple leans at a slight angle. The main temple was built in 1670 by Balbir Singh Chauhan and leans at an angle of 47° and is dedicated to the **God Bimaleswar Shiva**. The God is also lean. But the peak of the temple is straight. Below flows the Mahanadi. If one sprinkles food in the water, (between of Jan-June) colourful *Cudo* fish can be seen. But, these fish, supposed to be followers of Shiva remain out of reach. There are numerous small hillocks, river flows in a curved manner alongside; one can take a boat-ride along this stretch; the atmosphere is particularly charming. One can go 29 km by bus or trekker and then walk down the remaining 3 km along village paths and visit Huma. However, one may also hire a jeep.

Nrusimhanath :

At the borders of Sambalpur and Bolangir Dists, on the northern slopes of the Gandhamardan mountains (which was lifted by Hanuman-son of the God of Wind, in the epic Ramayana) there is Nrusimhanath Temple. When the Gods were pestered and annoyed by the *Asuras* (demons) Vishnu appeared to destroy them. Then, the demons disguised themselves as mice hid in this mountain. Vishnu then took the form of half lion-half cat and came to the mountain to kill these monsters. In the memory of this, in 1431, Bhaijal Deo built this temple, which is full of legends. Here, Lord Nrusimhanath i.e. Vishnu is in the form of *Marjarkesari* or the Cat-Lion-the body is that of a lion and the head that of a cat. The altar of the God is made of touchstone. However, the garlands prevent to get a view of the God. The architecture of the temple too is beautiful. At the door of the temple is an ivory image of the Goddess Lakshmi (Goddess of Prosperity), Jay-Vijay, Baman, Nrusimha and Baraha are incomparable. There are also images of Durga, Ganesa and the *Dwarpal* (sentry) near the temple. Near the Panchapandav ghat there are the Gods-Brahma-Vishnu and Maheswar, who signify Creation, Life and Destruction-the architectural beauty is also of a very high standard. Devotees are also given a special lunch (*bhog*) after prayers. At the time of *Dol Purnima* and other festivals at the time of full moon there is a special festival to attend which people come from far places. There are buses too, which ply right upto the doors of the temple during the time of the festival. Besides this, there are festivals during *Baisakhi Chaturdashi, Srabani Purnima, Ratha Yatra, Maghi Purnima* and *Dol.*

Bhimadhar, Gadadhar, Guptadhar, Pitrudhar-Kapildhar, Chaladhar and other streams come down from the mountains; they flow far below in the form of small rivulets. It's name is Paapharan. On bathing in it, it is believed that ones sins are washed away. There is also the Sitakund and Gokund.

Balangir :

Balangir road station is on the Jharsuguda-Sambalpur-Balangir-Titlagarh rail route. Buses also ply regularly along this route. Amidst mountains and forest, the city of Balangir is also the head quarter of Balangir. Small streams run down the mountains. A midst all the beauty of nature, there are fine temples and it is rich in archaeological findings. There are also average hotels -*Sahu L, Geeta L, Tourist Home, Balangir L, Toliday Inn. H Paradise* and *Tara L, etc*. From Balangir one can go to Harishankar, Nrusimhanath and Patnagarh by local bus. Due to irregular bus service, one may hire a jeep.

At a distance of 38 km from Balangir is Kuanripatna. It was the centre of the Tantra meditation 9th century, now it is in **Patnagarh.** Amidst the ruins of temples built by the Chauhan kings, there is also the 12th century Someswar Shiva Temple, Patneswari and Shyamaleswari Temples, which attract the tourist. There is also the **Sonepur** temple 48 km from Balangir. Besides the Lankeswari Temple built on a hillock, there are other temples in Sonepur. The PWD also has a bungalow in Sonepur.

Ranipur-Jharial :

They are 2 neighbouring villages and are renowned as Somatirtha. Between the 8th and 10th centuries, covering 15 km, more than 40 temples were built in Somatirtha. They are different not only in size, but in the architectural artistry also. The influence of Shiva, Buddhism, tantra and inclucence of Vaishnavism are found in Somatirtha. (In particular, Rajarani Temple, Indranath temple, Chaushat Yogini Temple etc.) Beneath the blue sky and surrounded by boundary walls, in the centre of the temple, in inbuilt crevices, there are images of *Yoginis* (female meditating figures). Indranath is probably the highest Rekh Deul made of brick in Odisha. The tourist ought to try and measure the magic stone from either end. Trains ply regularly to Titlagarh from Jharsuguda via Sambalpur-Balangir and then along Raigarh-Waltair rail line. Ranipur-Jharial is 30 km away and one can reach from Titlagarh by bus, mini-bus and taxi. Buses, taxis and mini-buses are available from the Dist Head quarter Balangir. There is also the *Panthasala,* Ranipur-Jharial, AB : Tourist Officer, Odisha Tourism, Balangir, Ph- (06652)22432. In Titlagarh, average hotels are available.

Rourkela :

Sundargarh district is to the north of Sambalpur district. This district is highly rich in minerals. Rourkela, one of the Steel Plant of India has been developed on the eastern bank of Brahmani river. In the past, it was an unknown village. It is located in Sundargarh district on Chhota Nagpur Plateau at the height of 219 m. Today it is world famous. The steel plant was founded with a capacity of 60 lakh-tons production as per agreement made on 15th August, 1953, with Kup Dimag Co of Germany. Covering 45 sq km a planned city has been developed keeping the steel plant as its centre. Steel is being manufactured here in LD system, hence Nitrogen is also produced. A fertilizer factory was also founded here in 1962. PRO's permission is required to visit the plant.

Indira Gandhi Park is another attraction of Rourkela are of which is 28 acre. With a Observation Tower, Lake, Children's Park, Mogal Park, Green house, Gulabbag, Mini Zoo and others have added the attraction of this park. It is an ideal place for evening walk.

(The

ODISHA TOURISM POLICY, 2016

The Industrial Policy Resolution (IPR) 2015 was announced in August, 2015. In the IPR, 2015, Tourism was declared as priority industry. In IPR, 2015 the fiscal incentives proposed for priority sector industries are lucrative than the Tourism Policy, 2013. The State Government have published Odisha Tourism Policy, 2016 with following objectives :

(i) To promote sustainable and green tourism with a view to create employment opportunities and to bring about socio-economic benefits to the community.

(ii) To preserve, enrich and promote Odisha's unique cultural heritage and environment with a view to achieve inclusive development, addressing the regulatory and tourism promotion/development functions in private public partnership (PPP) mode at all levels in an effective and well co-ordinate manner.

(iii) To promote Odisha as one stop destination to experience its great history, culture, society and natural beauty so as to boost foreign and domestic tourist arrival in the state.

(iv) To promote circuit tourism in association with other State of Eastern zone of the country to facilitate easy arrival and movement of the tourist.

(v) To upgrade skill and professionalism and promote employment opportunities in tourism sector.

(vi) To promote digital tourism.

(vii) To promote responsible tourism and developed tourism product in an environment friendly manner.

(viii) To promote barrier-free tourism

(ix) To promote

(a) Beach Tourism

(b) Eco Tourism

(c) Buddhist Tourism

(d) Heritage Tourism

(e) Religious Tourism

(f) Knowledge Tourism

(g) Medical Tourism

(h) Travel Tourism

(i) Caravan Tourism

(j) Wellness Tourism

(k) Cruise Tourism

(l) Sand Art Tourism and

(m) Adventure Tourism in a mission mode

United Kingdom and U.S.A was the major tourist generating markets of Odisha during the year 2015 with 8921 and 7847 tourists respectively out of the total tourist arrival of 66,971 followed by France, Germany, Australia and Malaysia.

West Bengal continued to be the major tourist generating state for Odisha contributing 14 percent of the total domestic toursits during 2015 followed by Maharastra, Madhya Pradesh, Chhatisgarh, Uttar Pradesh and Jharkhand.

TABLE - 18

Hotel, Position in Odisha

Year	Number of Hotels				Number of Rooms	Number of Beds
	HSG	MSG	LSG	Total		
2004	76	183	646	905	18541	35314
2005	84	191	659	934	19265	36771
2006	103	226	824	1153	22820	43828
2007	62	204	936	1202	23341	44948
2008	86	211	935	1232	24197	46809
2009	96	232	948	1276	24962	48408
2010	114	263	942	1319	26531	51233
2011	150	245	933	1328	27291	52867
2012	251	288	918	1457	30770	60077
2013	306	356	923	1585	33349	65967
2014	334	399	956	1689	35373	70600
2015	383	455	921	1759	36386	73094

Source : Tourism Department Government of Odisha

11

AGRICULTURE, IRRIGATION, ANIMAL HUSBANDRY, FISHERIES, FOREST AND TREE COVER, WILD LIFE CENSUS, ENVIRONMENT AND POLLUTION CONTROL

State agricultural policy, production of Food grains, Rice and HYV Paddy, Horticultural crops, Cropping pattern and Intensity, Floriculture, Fertiliser and Pesticides, Agricultural Inputs, Irrigation, Crop Insurance, Land holdings, Policies and Development scheme, NFSM and SHM, PKVY and RKVY, BKKY and IWMP, BKVY and PMSKY, NHM and MIDH, OUAT and ICAR, APICOL and OAIC, OSCDC and OSSC, Types of agriculture and Problems, Animal Husbandry, PDE and ILDP, Omfed and Opolfed, Fisheries and CIFA, Fish production, Forestry and Environment, OFDC and MGNRES, OBDA and OBD, Wild life census, Ecology and Environment, Climate change action plan and awards.

Agriculture play a dominant role in the economy of the state like Odisha. While Agriculture and Animal Husbandry contributed 28.13 percent of the Net Domestic Product of the state (GSDP) in 2001-2002, the agriculture alone provided direct and indirected employment to around 65 percent of the total workforce of the state as per the 2001 census. Agriculture in Odisha continued to be characterised by the low productivity due to traditional agricultural practices, inadequate capital formation and low investment, inadequate irrigation facilities and uneconomic size of holding. Nearly 62% of the cultivable land is rainfed and exposed to the vagaries of monsoon. Agriculture is a complex and multidimensional enterprise. Its development depends on various factors like agro-climatic conditions, technology, inputs, system of land holdings and other social-economic factors.

But Odisha achieved transient success in terms of increased net area sown, food security, irrigation, enhancement in farmer's income etc. Odisha had 41.04 lakh cultivators and 67.40 lakh agricultural labourers out of 175.42 lakh total workers in 2011 census. The share of cultivators and agricultural labourers together have been diminished by 3 percentage points from 64.8 percent to 61.82 percent between 2001 and 2011. The falling share is due to less participation of women cultivators which decreased by 19 percentage points from 9 lakh to 7.29 lakh between 2001 to 2011. However, the number of male cultivators has increased by 0.28 lakh during the decade. Among the districts, Balasore has the highest number of cultivators (2.89 lakh), Mayurbhanj, highest number of agricultural labourers

(5.69 lakh) and persons working in household industries (1.14 lakh), while Ganjam district recorded highest in the category of other workers (5.95 lakhs). The share of Agriculture and Animal Husbandary, Forestry and Logging and Fishery sub-sectors to Gross State Domestic Product (GSDP) of broad agriculture sector are highly skewed with 80 percent, 12 percent and 8 percent respectively. However, these 3 sub-sectors contribute only 12 percent, 2 percent and 1 percent respectively to state GSDP.

Recognising the importance of this sector to the State's economy, the State Government have come up with a comprehensive Agriculture Policy according agriculture the status of an industry. The objectives of the above policy shall be pursued vigorously during the Tenth Plan to make Agriculture sector one of the growth engines for accelerating the pace of development of the State. The State Agriculture Policy 1996 aims at doubling the production of foodgrains and oil seeds, generation of adequate employment opportunities in the rural sector and eradication of rural poverty within a specific time frame. The main objectives set out in the **State Agriculture Policy 1996** are as follows :

(i) To enhance the status of Agriculture from the present level of subsistence agriculture to a profitable and commercial venture, so that young persons can accept agriculture as a means of self-employment.

(ii) To generate adequate employment opportunities.

(iii) To adopt integrated programmes for problem soils such as water logged areas, areas with soil erosion, dry/rainfed areas, area under shifting cultivation, waste land, saline and alkaline soil etc.

(iv) To create entrepreneurship in the field of agriculture and horticulture.

(v) To create skilled labourers for management of modern agriculture.

(vi) To help mechanisation of agriculture to increase productivity.

(vii) To establish Agro-based Industries and Food Processing Industries.

(viii) To provide irrigation facilities to 50% of cultivable land through completion of incomplete irrigation projects and promotion of individual and group enterprise.

(ix) To promote private enterprise in the marketing of agricultural produces.

(x) To identify and promote thrust crops in different agro-climatic zones of the state.

(xi) To reorient agriculture towards export.

Eleventh Five Year Plan (2007-12) :

The objective of the 11th Plan is to achieve 4% sustainable annual growth in agricultural production through better management of natural resources and scientific management of crops. It also aims at doubling farmers incomes by the end of the Eleventh Plan. The following sectorial plan strategies have been envisaged for realizing these objective.

- Substantially improve irrigation potential and its utilization.
- Improve water management, rain water harvesting and watershed development.
- Reclaim degraded land and focus on soil quality.

- Bridge the knowledge gap through effective extension.
- Diversify into high value outputs, fruits, vegetables, flowers, herbs and spices, medicinal plants, bamboo, bio diesel etc., but with adequate measures to ensure food security.
- Mixed farming to be encouraged and in farm animal husbandry and fishery activities to be promoted.
- Provide easy access to credit at affordable rates.
- Improve the incentive structure and functioning of markets.
- Refocus on land reform issues.

Production of Foodgrains :

Foodgrain production in the state showing a fluctuating trend due to various natural calamities. During 2001-02, there was a record production of foodgrains of 75.40 lakh MT which declined to 35.55 lakh MT in 2002-03 due to severe drought in Kharif 2002. Again the foodgrain production increased to 71.52 lakh MT in 2003-04. Due to excessive rainfall with cyclonic weather in the coastal belt, the foodgrain production again declined to 69.65 lakh MT during 2004-05, which was less by 2.61% over 2003-04. During 2005-06, the foodrain production in the State was about 73.59 lakh MT, which exceeds the foodgrain production of 2004-05 by 5.66%. But it is still 2.41% lower than the foodgrain produced during 2001-02. During 2006-07, the foodgrain production in the state was about 73.45 lakh MT which is almost same as the foodgrain production in 2005-06. If we compare foodgrain production in 2005-06 with the present condition in 2015-16 (Table - 19), the growth and rise is remarkable.

TABLE - 19

Production of Major Food grains in Odisha (in 000′ MT)

Crop	2011-12	2012-13	2013-14	2014-15	2015-16
Rice	5807	9497	7613	9845	5875
Maize	212	227	264	188	111
Other Cereals	50	9	10	10	13
Total (A) Cereals	6069	9786	7941	10088	6033
Tum	115	128	124	124	123
Other Pulses	132	264	259	279	232
Total (B) Pulses	247	424	419	439	385
Total Foodgrains (A+B)	6316	10210	8360	10527	6418
Groundnut	79	82	87	62	56

Crop	2011-12	2012-13	2013-14	2014-15	2015-16
Other Oil seeds	87	64	54	52	23
Total (C) Oilseeds	166	264	170	142	97
Cotton	231	336	299	316	298
Other Fibres	120	29	31	27	24
Total (D) Fibres	351	434	397	403	366
Sugarcane	885	952	937	723	577
Potato	63	65	71	104	57
Other Crop	75	74	74	73	69
Ginger	135	134	134	133	128
Total (E) other crops	1158	1226	1217	1034	832
Grand Total A + B + C + D + E	7991	12134	10144	12106	7713

Source : *Director of Agriculture and Food Production, Odisha*

Directorate of Economics and Statistics, Odisha

Food grain the core product of crop sector in Odisha. Rainfall and its temporal and spatial distribution have direct bearings on the foodgrain production and productivity in the state. Recurring natural hazards led to varying degree of foodgrain production since last decade. Flood, cyclone and drought extensively damaged the foodgrain production in alternative years of 2011-12, 2013-14 and 2015-16. Consequently, foodgrain production declined sharply to 64.18 lakh MT in 2015-16 by 39% after a bumper crop of 105.27 lakh MT during 2014-15. Rice production in particular, fell by 40% over the rice production of 2014-15. This was due to irregular and less rainfall due to weak monsoon and the influence of EI Nino, movement of Jet Stream are the other geographical phenomena influencing the flow of weak monsoon. This has been explained in Climate chapter. Foodgrain production in Odisha from 2011-12 to 2015-16 is given in Table 19.

MAJOR FOODGRAIN RICE

Rice (*Oryza Sativa*) is a tropical monsoon crop, which means that its cultivation requires high temperatures to germinate, bloom and mature (10° to 21°C during sowing period and 35°C to 37°C at the time of harvest) and sufficient rainfall. As such, monsoonal lands are best suited to rice production. It is of interest to note that where rainfall exceeds 200 cms., rice is dominant; with 100 cms. to 200 cms. it is still important, under 100 cms., it is grown only with irrigation. Its cultivation is done on heavy clay or clay-loams. Such soils are capable of holding water and are found in tank beds and deltaic areas. It is also grown on alluvial, red and lateritic soils. A large supply of cheap labour is essential in preparing seed-beds; in broadcasting seeds or in transplantation of plants from nurseries to fields, in winnowing and harvesting, operations. Rice is sown in India in **three** ways - by broadcast, by drill and by transplantation from a seed-bed. In Odisha both broadcast and transplantation method of cultivation is generally followed. More labour is required because seed-beds are to be highly manured before the seeds are sown. After 4 weeks the seedlings are uprooted, tied in bundles and carried to the field for plantation. The bumper harvest is generally seen in this method of cultivation.

Rice is the singlemost important food crop in India that occupies 44.0 million hectares of agricultural land which is the largest rice area in the world. It is grown in all most all states of India and the state of Odisha contributes 4.4 million hectares to rice cultivation practice (IRRI-2005). Rice is grown in three seasons in *India*. Autumn and winter (or Kharif) season from June to October and Summer (or *Rabi*) from December to May. The Kharif season accounts for 88% and Rabi season accounts for 12% of the total production of rice.

Rice constitutes more than 90% of the total foodgrain production in the state. The average yield rate of rice in Odisha which was **15.31 quintal / ha. in 2005-06** has increased to 15.34 quintal / ha. during 2006-07. The per capita production of foodgrains per annum which was 180 kg in 2004-05, has also increased to 190 kg. in 2005-06 and which has remained at same level during 2006-07.

The "Integrated Cereal Development Programme- Rice" is being implemented since 1994-95, with the objective of augmenting paddy production and productivity as it is the single major cereal crop of the State. A major factor to boost agricultural production is to increase the coverage under HYV paddy. There has been a significant expansion of area under HYV paddy in Odisha despite inadequate irrigation facilities, shortage of inputs like HYV seeds, fertilizers and pesticides etc. Area under HYV paddy has increased by 18.60% during the Tenth Plan Period, i.e. 2002-07. The total irrigated and un-irrigated area under HYV paddy during 2006-07 was 3162.59 thousand ha. Area under HYV paddy over the years is presented in Table 20. The State Agriculture Policy, 1996 accords priority to multiplication of high yielding varieties of seeds to replace the traditional varieties being used in the State. In order to increase the production and productivity of rice, 314 Farmers Field Schools (FFS) were organised and 15700 rice growers were trained in various aspects of rice production. It has been programmed to organise one FFS on rice in each block of non ATMA districts during 2007-08 and a total 3600 farmers will be trained in 144 nos. of FFS.

During 2006-07, about 1400 farmers were sent to different places within the state and 320 farmers to outside the state on exposure visits for experiential learning and adoption of best practices with an expenditure of ₹ 23.60 lakh. It has been proposed to send 500 farmers on exposure visit within the sate and 210 farmers to outside the state with an outlay of ₹11.72 lakh during 2007-08. The district-wise estimate of area, production and yield rate of HYV paddy 2015-16 is given in Table-21.

With a view to encourage the farmers, to take up seed production early and to take up early varieties of paddy suitable for escaping drought condition and saline-tolerant varieties of paddy in coastal districts, production incentive is being given to farmers through Odisha State Seeds Corporation. During 2006-07, incentives amounting to ₹ 35.00 lakh have been given for 35,000 qtls. of seeds. It has been proposed to provide incentive for 31,700 quintals during 2007-08 with an outlay of ₹ 31.70 lakh.

In order to encourage varietal replacement and use of HYV paddy seeds, about 45,000 quintals of paddy seeds were sold to the farmers in a subsidized rate during 2006-07 and for encouraging use of green manure, incentives @ ₹ 200/- per quintals of Dhanicha seeds were provided to the farmers and total 330 quintals of Dhanicha seeds were distributed during 2006-07. To know the present status, please compare Table No. 20 and 21.

Area Under HYV Paddy

Cultivation of High Yielding Variety (HYV) paddy is widely accepted by the farmers and the area under HYV paddy cultivation exhibits an increasing trend. About 92% of the total area under paddy is under cultivation of HYV paddy in 2015-16 as compared to 91% in 2014-15 and 89% in 2013-14. Area under HYV paddy is given in Table - 20.

TABLE - 20

Area Under HYV Paddy

	Autumn		Winter		Summer		Total	
Year	Irrigated	Un-irrigated	Irrigated	Un-irrigated	Irrigated	Un-irrigated	Irrigated	un-irrigated
2013-14	25.80	462.79	1027.21	1894.96	300.54	–	1353.55	2357.75
2014-15	25.68	479.03	1038.4	1948.61	301.25	–	1365.33	2427.64
2015-16	22.83	462.22	1052.31	1863.57	233.40	–	1308.54	2325.79

Source : Directorate of Economics and Statistics, Odisha

In district-wise estimation of area is hectares, Bargarh district is in first position with 307365 hectares under HYV paddy cultivation and the production of paddy in quintals (8961435) is also highest (Table - 21). But Bhadrak district stands first as per yield rate per hectare in quintal in Odisha. The yield rate of rice per hectare in quintals again Bhadrak district is in the top most position (27.5 quintals per hectare) in Odisha.

TABLE - 21

District-wise Estimates of Area, Production and Yield Rate of HYV Paddy (2015-16)

Districts	Area in hectare	Paddy (in qtls)		Yield rate (qtls./hect.)	
		Paddy	Rice	Paddy	Rice
Angul	79653	954525	62994	12	7.92
Balangir	190955	2728378	1800729	14.29	9.43
Balasore	205211	5516938	3641177	26.88	17.74
Bargarh	307365	8961435	5914550	29.16	19.24
Bhadrak	135402	5642002	3723722	41.67	27.5
Boudh	58417	863735	570064	14.79	9.76
Cuttack	119178	3677555	2427184	30.86	20.37
Deogarh	47349	714205	471376	15.08	9.96
Dhenkanal	84154	2037029	1344437	24.21	15.98

Districts	Area in hectare	Paddy (in qtls)		Yield rate (qtls./hect.)	
		Paddy	Rice	Paddy	Rice
Gajapati	36508	541790	357581	14.84	9.79
Ganjam	242022	7051599	4654055	29.14	19.23
Jagatsingpur	75909	3037933	2005036	40.02	26.41
Jajpur	98619	1934363	1276680	19.61	12.95
Jharsuguda	46116	657179	433738	14.25	9.41
Kalahandi	198462	3364773	2220753	16.95	11.19
Kandhamal	17191	262478	173232	15.27	10.08
Kendrapara	90111	2998864	1979249	33.28	21.96
Keonjhar	177979	3089656	2039171	17.36	11.46
Khurda	85818	1979795	1306661	20.37	15.23
Koraput	113361	3516702	2321023	31.02	20.47
Malkangiri	75321	1656068	1093006	21.99	14.57
Mayurbhanj	248715	3989915	2633344	16.14	10.59
Nuapara	90412	1181983	780109	13.07	8.63
Nayagarh	78194	1050077	693052	13.43	8.86
Nawarangpur	125417	2419884	1597123	19.29	12.73
Puri	119326	4077094	2690881	34.17	22.55
Rayagada	48559	890181	587520	18.33	12.1
Sambalpur	147811	2357372	1551904	15.91	10.5
Sonepur	131511	5009401	3306207	38.09	25.14
Sundargarh	159346	3105445	2049592	19.49	12.86
ODISHA	3634334	85262354	56273137	23.46	15.48

Source : Directorate of Economics and Statistics, Odisha

Area Under Horticultural Crops

The agro-climatic conditions of Odisha are favourable for the production of different types of vegetables, fruits and spices. The KBK districts, Gajapati, Kandhamal, Keonjhar and other districts are conducive to intensive horticultural activity. Among long duration fruits, mango, cocconut, cashewnuts, sapota, jackfruit, orange and litchi are most favourable in Odisha. The area under different fruit cultivation is given in Table - 22.

TABLE - 22

Area, Production and Yield Rate of Fruits

(Area in '000 ha, Production in '000 MT, Yield rate quintal / ha)

Fruits	2013-14			2014-15			2015-16		
	Area	Production	Yield rate	Area	Production	Yield rate	Area	Production	Yield rate
Mango	197.52	751.02	38.02	197.74	769.93	38.94	199.29	778.69	54.23
Banana	25.06	476.60	190.18	24.76	469.25	189.52	24.47	462.64	201.02
Citrus	27.52	268.01	97.39	27.54	268.37	97.45	27.91	267.96	104.32
Pineapple	0.84	10.38	123.57	0.93	11.60	124.73	0.95	11.62	147.11
Papaya	3.28	72.18	220.06	3.01	69.88	232.16	3.03	70.10	259.64
*Coconut	50.78	3255	6410	5068	3255	6423	5091	3260	64.03
Others	71.63	570.10	79.59	73.31	567.46	77.41	73.31	567.47	86.71

* Coconut in lakh numbers

Source : Directorate of Horticulture, Odisha

Area Under Potato and Sugarcane

These two crops are also important in Odisha from consumption point of view. The area under potato decreased from 8 thousand hectares in 2014-15 to 5.63 thousand hectares in 2015-16 although it shares a mere 0.14 percent of the total cultivated area of the state. Sugarcane is cultivated mainly in Cuttack, Sambalpur, Bolangir, Kalahandi and Puri districts. Area under sugarcane cultivation is equally very low with 0.18 percent share of the total cultivated area of the state. During 2015-16, sugarcane was cultivated in 9 thousand hectares as compared to 10 thousand hectares in 2014-15. (Table - 19)

Pulses :

Next to paddy, pulses are the important foodgrain crops. During 2006-07, the total area under pulses accounted for 7.90 lakh hectares which constitutes 14.62% of the total area under foodgrain (54.03 lakh hectares) and contributed 4.79% (3.52 lakh MT) of the total foodgrain production of 73.45 lakh MT in the State. However the productivity of the pulses in the State is around 444 kg./hectares as against national average of 609 kg./hectares. Non-availability of suitable HYV seeds is the main constraint for productivity. Therefore to meet the minimum requirement of the state, it has been proposed to increase the area under pulses and to raise productivity by adopting dry land farming technique mixed and intercropping system and use of quality seeds and fertilizers. National Pulse Development Programme is being implemented in the State since 1994-95 with the objective of increasing production and productivity of pulses in the State Assistance is being provided for breeder seeds, foundation seeds and Block demonstration.

During 2006-07, about 10.35 qtls. of Breeder Seeds of different pulse crops were procured through Govt. of India allocation for production for foundation seeds and 24 quintals of foundation seeds were processed in 2006-07 for production of certified seeds. Subsidy to the tune of ₹ 29.60 lakh was provided on 3700 qtls. of certified seeds sold to the farmers, it has been programmed to procure 21 quintals of Breeder Seeds for production of 100 quintals of foundation seeds and 2000 quintals of certified seeds during 2007-08 with an outlay of ₹ 11.55 lakh. During 2006-07, 96 farmers training programmes were conducted and 480 farmers were trained for up-gradation of their knowledge on production techniques. Total area of pulses cultivated was 826,000 hectares in 2014-15 decreased to 775,000 hectares in 2015-16. (Table - 19)

Oil seeds :

India is one of the leading oilseed producing countries of the world. The cultivation of groundnut (*Arachis hypogaea*) requires a light soil well drained, sandy loams rich in organic matter. The red, yellow and black cotton soils of the Peninsular India suit it well. About 75 cm to 85 cm of rainfall may be considered necessary. In Tamil Nadu and Maharastra it is raised under irrigation. It requires about 20°C to 25°C temperature. Dry weather is needed at the time of ripening. Linseed (*Linum usitalissimum*) though principally a temperate crop requiring low temperature and humidity for its growth, is cultivated in tropical areas also mostly on low elevations and plains and rainfall ranging from 75 cm to 150 cm. India is also largest sesamum (*Sesamum indicum*) producing country in the world. It thrives well on light, sandy soils and on black cotton soil. India is the second largest producer of Caster seed (*Ricins cammenis*) being surpassed by Brazil. The oil is used for domestic, medicinal and industrial purposes. The oilcake is used as fertilizer. It thrives well in warm and relatively dry climate, with an annual rainfall of 50 cm to 75 cm. It generally grown on red sandy loams and on light alluvial soil. As a **Kharif crop**, it is sown between May and July and harvested in January, February; while as **Rabi crop,** it is sown between September-November and harvested between March-April. It is generally grown up to an elevation of 1600 metres, provided that frost is absent.

The major oil seeds grown in the state are groundnut, sesamum, mustard and Sunflower cultivation has also been introduced in western Odisha. For imporving oil seeds production in the State, emphasis is being laid on production of certified seeds, supply of input kits, subsidised sale of quality seeds, plant protection chemicals and equipments and farm implements under the Centrally Sponsored Plan Scheme "Oil Seeds Production Programme" (OPP). The coverage under oil seeds in 2006-07 was 2.57 lakh hectares with production level of 1.49 lakh MT as against coverage of 2.71 lakh hectare and production level of 1.63 lakh MT during 2005-06. Out of the total area under oilseed crops during 2006-07, groundnut was cultivated in 30.6% of the total area covered under oilseeds, followed by Niger 21.3% and Sesamum (Till) 19.6%.

In order to improve the availability of HYV seeds, procurement of breeder seeds and production of foundation seeds and certified seeds under seed village programme were taken up during 2005-06 with an expenditure of ₹ 28.56 lakh. During 2006-07, 420 qtls. of Breeder seeds were procured from Govt. of India with an expenditure of ₹ 18.89 lakh and 939 qtls. of foundation seeds and 1600 qtls. of certified seeds have been produced. Total oilseed cultivated 212,000 hectares in 2014-15 but it decreased to 137,000 hectares in 2015-16 (Table - 19)

Commercial Crops :

India ranks first in sugarcane (*Saccharum officinarum*) production but in actual production of sugar it is much behind Hawaii, Java, Cuba and Brazil. Sugarcane grows best in area with 20°C to 26°C temperature. Frost is detrimental to cane. Short cool dry winter season during ripening and harvesting is ideal. About 150 cm rainfall and deep rich loamy soils are ideal for it, which are neither too acidic nor too alkaline. It is even grown on black soil. **Jute** is the best **fibre** in India, obtained from the inner bark of two important species. *Corchorus Capsularis* (Or. white Jute) and *Corchorus olitorius* (toss jute) which grow to the height of 2 to 4 metres. It is demanded for the manufacture of gunny bags, carpets, ropes, rugs and tarpaulin etc. A hot and damp climate is the best for it. More than 150 cm rainfall and average 80 to 90 per cent humidity is essential with a minimum temperature of 26°C. It is grown on soil which is enriched by new allevium broguth by river inundation. Jute grows to perfection on loamy soils, as water sinks quickly into it. The clayey soils give the heaviest yield and sandy soil produce coarse fibre. India has a largest area under cotton cultivation in the world and produces 8.4 percentage of world's production. Cotton is a tropical crop and minimum temperature should not fall below 18°C. Rainfall should be moderate ranging between 50 cm to 75cm. It should not be over 85 cm for them the crop is destroyed. **Cotton** is a Kharif crop of India and is closely associated with Regur or Black Cotton Soil. Cheap labour is needed for sowing as well as picking.

The development of commercial crops like - sugarcane, jute, pesta, cotton, soyabean, groundnut, potato, chilly and onion is being given more thrust to improve the rural economy. Cotton is a major commercial crop predominately grown in the KBK districts in Kharif season. Area coverage under cotton is growing in Bolangir, Kalahandi and Rayagada districts. The production of cotton increased from 0.57 lakh bales in 2005-06 to 1.08 lakh bales during 2006-07. In the coastal districts, river bed **potato** cultivation is being promoted by using certified potato seeds and other improved planting materials. Cultivation of sugarcane, which is a high-value commercial crop, is being widely accepted by farmers. Steps are being taken to cover at least 1.5 lakh ha. under sugarcane during the next five years. The resulting production should provide sufficient feedstock not only to the existing sugar mills that are currently in operation in the State but also to the sugar mills that are likely to come up in the coming years. Sugarcane growers are provided with quality cane seeds, farm implements and drip irrigation under two schemes, namely, 'Sugarcane Development Programme' under the State Plan and 'Sustainable Development of Sugarcane Based Cropping System' under the Centrally Sponsored Plan. The production of sugarcane increased from 10.73 lakh M.T. during 2005-06 to 12.74 lakh M.T. during 2006-07. Present status in 2014-15 and 2015-16 is given in Table - 19. In 2015-16 the area under cultivation of sugarcane, jute, cotton and potato have decreased compared to 2014-15. (Table - 19)

Cropping Pattern :

Agro-climate conditions exercise big influence of the type of crop to be grown in an area. More than 75% of the cultivated area in the State is covered under paddy crop Since the Eighth Plan, efforts are being made to divert land from paddy to cash crops like pulses, oil seeds, sugarcane, potato etc. to ensure better returns.

TABLE - 23

Cropping Pattern of Principal Crops

(area in thousand hectares)

Crops	2014-15		2015-16	
	Area	% to total	Area	% to total
(A) CEREALS				
Rice	4166	73.92	3942	75.32
Wheat	1	0.02	'S'	S
Maize	92	1.63	55	1.05
Ragi	51	0.90	46	0.88
Others	30	0.53	34	0.65
Total (A) CEREALS	4340	77.00	4077	77.90
(B) PULSES				
Gram	47	0.83	39	0.75
Arhar	138	2.45	138	2.63
Other Pulses	641	11.37	598	11.42
Total (B) PULSES	826	14.66	775	14.80
Total Food Grains A + B	5166	91.66	4852	92.70
(C) OILSEEDS				
Groundnut	49	0.87	51	0.97
Sesamum	26	0.46	20	0.38
Rapeseed and Mustard	10	0.18	7	0.13
Caster seeds	11	0.20	11	0.21
Others	116	2.06	48	0.92
Total (C) Oilseeds	212	3.77	137	2.61

Crops	2014-15		2015-16	
	Area	% to total	Area	% to total
(D) FIBRES				
Colton	127	2.25	125	2.39
Jute	1	0.08	1	0.02
Other fibres	17	0.30	14	0.27
Total (D) fibres	145	2.57	140	2.68
(E) Other Crops				
Sugarcane	10	0.18	9	0.17
Tobacco	2	0.04	1	0.02
Potato	8	0.14	6	0.11
Chillien	76	1.35	72	1.38
Ginger	17	0.30	17	0.32
Total (E) Other crops	113	2.00	105	2.01
Grand Total (A + B + C + D)	5636	100	5234	100

***Source :** Directorate of Agriculture and Food Production, Odisha*

Cropping Intensity

Cropping intensity is one of the indicator of the level of agricultural development. It went up from 151% in 2001-02 to 158% in 2006-07. Due to development of irrigation facilities more areas were brought under cultivation and farmer could raise more than one crop in same land in the same year. Further it is also revealed that the cropping intensity is highest in Puri district (208%) followed by Jajpur district (190%) and Jagatsinghpur (188%). Lowest cropping intensity has been recorded in Sundargarh district (138%). Table 22 shows net area sown, gross cropped area and cropping intensity from 2000-01 to 2006-07. The cropping intensity shows an increasing trend since 2003-04.

TABLE - 24

Cropping Intensity for the period from 2001-02 to 2006-07 (P)

(Area in thousand hectares)

Year	Net area sown	Gross cropped area	Cropping intensity (%)
2000-01	5,829	7.878	135
2001-02	5,845	8,798	151
2002-03	5,680	7,853	138
2003-04	5,796	8,637	149
2004-05	5,739	8,718	152
2005-06	5,691	8,928	157
2006-07	5,654	8,960	158

Source : *Directorate of Agriculture and Food Production, Odisha.*

There are mainly three ways to meet the increasing demand for food and other farm products. One way is to expand the net area under cultivation, the second is to intensify cropping over the existing area and third is to raise productivity of production per hectare. Thus, raising the cropping intensity and productivity seems to be more viable strategies to increase production of farm products and farmers' incomes. Cropping intensity implies raising a number of crops from the same field during one agricultural year. Higher cropping intensity means more than one crop from the same area is an agricultural year.

In India cropping intensity during 2012-13 is the highest in Punjab followed by West Bengal and Haryana.

The cropping intensity in Odisha has, also increased from 157 percent in 2005-06 to 167 percent in 2012-13 and in 2015-16 it is 146 as may be seen from Table - 24 (A).

TABLE - 24 (A)

Cropping Intensity in Odisha

Year	Net area sown (in '000 hect.)	Gross cropped area (in '000 hect.)	Cropping intensity (%)
2005-06	5691	8928	157
2011-12	5292	8799	166
2012-13	5331	8879	167
2013-14	5424	9054	167
2014-15	5496	9011	164
2015-2016	5608	8180	146

Odisha ranked fourth in terms production of vegetables. The total production of vegetables was 9067.65 TMT in 2015-16 as compared to 9460.58 TMT in 2014-15.

Odisha contributed to about 4 percent of spice production in India. The production of spices in 2015-16 was 847.97 TMT which is lower than the production of 880.79 TMT in 2014-15.

Floriculture :

Odisha's contribution is about 3% of total flower production in India. There is an increasing demand for flowers like rose, marigold, gladioli, tube-rose etc. in the State and most of the flowers are being imported from the neighbouring state like West Bengal, Andhra Pradesh. Therefore emphasis is being given to encourage farmers of the State to increase their farm income as well as to create employment opportunity through floriculture. Financial assistance up to 50% of the cost of cultivation for small and marginal farmers and 33% for other farmers ranging from ₹ 7920/- per hectare to ₹ 45,000/- per hectare is being provided for commercial cultivation of flowers. Table-25 shows the area and production of different floricultural crops since 2003-04. It revealed from the table that floriculture becoming popular among farmers.

TABLE - 25

Area and Production of different Floricultural Crops

(Area in ha./Prodn. in Qtl.)
(Gladioli - in nos. of lakh spike)

Year	Marigold		Rose		Gladioli		Tube rose	
	Area	Production	Area	Production	Area	Production	Area	Production
2003-04	194.64	14,581	41.62	92.19	11.37	11.37	33.62	540
2004-05	221.05	16,599	46.14	98.63	12.07	12.06	34.92	555
2005-06	243.05	17,514	111.55	245.55	129.64	129.65	107.50	1515
2006-07	333.00	26,640	246.25	505.86	311.70	311.70	196.00	1960
2014-15	2735	245810	1870	3598	2374	2359	511	1282
2015-16	2609	245820	1857	3575	1578	1558	503	1281

P : *Provisional*

Source : Directorate of Horticulture, Odisha, Bhubaneswar

Land Reforms :

The main objective of land reforms is to establish a new agrarian structure based on social justice by reducing inequalities in possession of lands. Land reform measures initiated in the state envisages, abolition of intermediary rights, tenancy reforms like regulation of rent, provision of security of tenure to tenants, distribution of ceiling surplus land to the landless agricultural labourers and small land holders, consolidation of land holdings, and updating and maintenance of land records.

Land ceiling is imposed to acquire surplus lands by the Government and redistributed it among landless people. By the end of 2006-07, 1, 62,587.201 acres of ceiling surplus land has been distributed among 1,45,523 landless persons.

Most of the farmers in the State possess marginal or no cultivable land due to fragmentation of holdings. Consolidation of holdings includes perparation, correction, and updating of land records and amalgamation of small and scattered holdings in a rational manner with a view to ensure better land management and optimum utilisation of limited water resources. From inception of consolidation measures 10,039 nos. of villages have been taken up for consolidation, out of which 797 villages have been excluded from the consolidation due to unsuitability. 130 villages have been amalgamated with nearby villages through 'Boundary Change Proceeding (BCP)' and 112 villages have been newly created through BCP and the balance 9224 villages with an area of 144681 hectares of land have been taken up for consolidation work. Consolidation work of 7956 villages with an area of 1204015 hectare have been completed by the end of 2006-07, out of which 5 villages with 439 hectares of land have been completed during 2006-07.

Crop Insurance :

The comprehensive Crop Insurance Scheme was introduced in the Sate in 1985 with an objective to provide financial support to farmers on the event of crop failure and to restore credit eligibility of farmers after crop failure for subsequent cropping season. The scheme was modified and made more liberal by Govt. of India and renamed as National Agricultural Insurance Scheme (NAIS) which is being implemented since 1999-2000, Rabi season. All farmers both loanee and non loanee, irrespective of their size of the holding, are covered under the scheme which covers risk in respect of loss of yield to crop due to natural calamities like flood, cyclone, storm, hailstorm etc. and other non preventive risks like natural fires, and lightening. Crops like paddy, groundnut, maize, ginger, red gram, mustard etc. Pradhan Mantri Krishi Bima Yojana in 2016-17 covers cent percent loss with very low premium rate. It also covers horticultural crops like cotton, sugarcane, potato, ginger, onion, banana etc. are covered under this scheme.

Dry Land Farming :

Dry land farming is practiced under rain-fed condition over more than 60% of the cropped area of the State but with a much lower yield rate. The programme of cultivation under rainfed condition aims at minimising dependance on monsoon through conservation of water in small projects and maximising production through diversification of crops, mainly from dry land paddy to pulses and oilseed crops. The intensive approach of this programme envisages development of watersheds for proper management of rain water while the extensive approach aims at diversification of crops. Hence, for stabilising production in rainfed areas, more particularly in the KBK, Gajapati and Kandhamal districts, farmers need to be motivated to divert uplands for growing drought resistant crops. Inter-cropping is a very appropriate practice in dry land agriculture since it offers a kind of insurance against total crop failure in drought years. It also ensures proper utilisation of soil moisture as well as plant nutrients. The ideal inter-cropping system in Odisha is cereals and pulses, pulses and ragi, maize and arhar, and groundnut and arhar.

Another measure taken to make dry land farming remunerative is mixed farming paddy crops, even in the medium and low land, suffer from moisture stress in the event of early retreat of monsoon. Early maturing variety of paddy cultivation is the solution to this problem. To store the monsoon run-off and to regulate release of water to increase moisture content of soil, water harvesting structures are being constructed in watershed areas.

Adoption of land and water conservation techniques and alternative land use systems like agro-forestry, agro-horticulture, and silvi pasture development can be taken up in dry land areas for increasing and stabilizing production.

Fertiliser and Pesticides

Chemical fertilizers a vital input to crop production. The rate of fertilizer used in the state still remains far behind the national average as may be seen from Table - 26. The detail of fertilizer consumption of Odisha is given in Table - 27. Further the use of fertilizers differs widely across districts. During 2015-16, out of 30 districts, only 10 districts were above the state average of 65.91kg/hectare. The per hectare consumption of fertilizer in Nawarangapur district is the highest i.e. 137.54 kg/hectare, followed by the Balasore (126.55 kg/hectare), while Kandhamal is the lowest consuming district (13.95 kg/hectare). Table - 28 reflects the district-wise fertilizer consumption during 2015-16. The pesticide consumption in the state declined to 0.93 TMT during 2015-16 which was 1.28 TMT during 2014-15. Per hectare consumption of pesticide also declined to 115 TMT during 2015-16 compared to 147 in 2014-15 (Table 29).

Table - 26

Fertilizer Consumption (kg/ha) in Major State

State	2010-11	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	278.41	242.92	199.66	226.72	237.23
Assam	67.59	66.04	66.04	65.41	125.08
Bihar	184.24	180.48	199.66	164.87	178.65
Gujarat	155.6	132.37	102.50	119.52	132.79
Haryana	224.85	220.07	208.08	179.48	221.44
Karnataka	181.43	193.68	126.98	136.06	176.15
Kerala	112.9	113.20	104.12	121.03	40.55
Madhya Pradesh	88.36	84.03	83.02	84.43	78.17
Maharashtra	133.65	137.90	112.83	127.07	125.60
Odisha	62.85	62.25	58.74	57.11	58.91
Punjab	243.56	242.64	249.49	216.73	227.46
Tamil Nadu	227.01	214.76	160.75	153.76	163.67
Uttar Pradesh	169.91	164.97	180.21	148.86	150.45
West Bengal	164.93	172.91	166.83	131.17	150.91
Rajasthan	60.64	55.33	54.35	49.69	54.51
All India	**146.32**	**142.33**	**130.79**	**125.39**	**128.08**

Source : *Agricultural Statistics, At a Glance-2014, GOI, Ministry of Agriculture, Odisha Figure from Directorate of Agriculture & Food Production, Government Odisha.*

Table - 27

Fertilizer Consumption in Odisha

(In Thousand MT)

Year	Nitrogen (N)	Phosphorous (P)	Potassium (K)	Total	Kg./ha.
2011-12	323.4	135.48	55.8	514.68	62.3
2012-13	315.04	124.19	50.97	490.2	58.7
2013-14	312.99	117.7	56.45	487.14	57.1
2014-15	314.07	126.22	59.24	499.53	58.9
2015-16	332.24	131.51	53.74	517.49	65.9

Source : *Directorate of Agriculture and Food Production, Odisha*

Table - 29
Pesticide Consumption in Odisha

Year	Total Consumption (000' MT)	Consumption per ha (Gms)
2011-12	1.16	148.00
2012-13	1.21	158.00
2013-14	1.44	169.00
2014-15	1.28	147.00
2015-16	0.93	115.00

***Source** : Directorate of Agriculture and Food Production, Odisha*

Agricultural Inputs

Improvement in farm yields depends upon a set of factors like technology, utilization of quality seeds, fertilizers, pesticides and irrigation etc. Each of these factors plays an important role in augmenting farm production and productivity.

Seeds

Quality seeds are critical input for improving agricultural yield rates. Odisha farmers mostly rely on traditional practice of farm-saved seeds for cultivation that lead to low seed replacement ratio in the State. During 2015-16, about 20,006 (Kharif) hectares were covered under village Programme and 5.06 lakh quintals of various kinds of seeds including 4.61 lakh quintals of paddy were procured in the State and about 0.45 lakh quintals of seeds of non-paddy crops were made available to the farmers, through Odisha State Seed Corporation (OSSC), which is the nodal agency for production, procurement and supply of quality seeds.

Soil Testing

Soil testing is an important technical support service needed by farmers. During 2015-16, about 1.75 lakh soil samples have been tested in 27 departmental Soil Testing Laboratories (STL) and eleven mobile STLs. During 2015-16, 2.48 lakh Soil Health Cards has been supplied to the farmers with necessary recommendations for fertiliser use to upkeep soil health. Besides, it has been programmed to establish 3 static and 6 mobile soil testing laboratories in the state during 2015-16, which enhances the capacity of testing soil samples to 3.65 lakh per annum. Soil testing services are provided to the farmers with a nominal charge of ₹ 5/- per sample. "Soil Health and Management" (SHM), a sub scheme under NMSA for up keeping soil health has been implemented during 2014-15 through promoting the use of organic manure and integrated nutrient management. During 2015-16, 3 Mobile, 3 Static, one Referral Soil Testing Laboratory and one Fertiliser Quality Control Laboratory have been established.

Irrigation

Extensive irrigation drives the crop sector towards optimum production & productivity. In Odisha, out of total cultivated land of 61.80 lakh hectares, about 54.74 lakh hectares (36.11 hectares during Kharif season and 18.03 lakh during Rabi season) irrigation potential

Table - 32

Source-wise Irrigation Potential Created in Odisha

Sl.No	Sources	2013-14		2014-15		2015-16 (Prov.)	
		Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
1	Major & Medium	13.83	6.32	13.91	6.37	14	6.41
2	Minor (Flow)	6.04	0.78	6.15	0.79	6.3	0.8
3	Minor (Lift)	7.08	3.51	7.94	3.9	9.04	4.4
4	Mega lift					0.03	0
5	Other Sources	6.58	5.91	6.86	6.12	7.34	6.42
	Total	33.53	16.52	34.86	17.18	36.71	18.03

Source : *Agricultural Statistics of Odisha, 2015-16*

(a) Master Plan for Irrigation : There is a master plan to provide at least 35 percent of the cultivable area of every block of Odisha in order to rationalize the irrigation development in 198 identified deficit blocks through the ongoing schemes such as BKVY, AIBP, RIDF, IICA and new schemes like check dams, deep bore well, mega lift are under implementation to achieve the target during 12th plan period. By the end of March 2016, out of the 198 deficit blocks (below 35 percent of irrigation), 96 blocks have achieved the target level of 35 percent.

(b) Jalanidhi Programme : The 'Jalanidhi' programme encourages farmers to go for creation of captive irrigation sources through shallow tube wells, bore wells, dug wells and river lift projects by way of administering back ended subsidy against creation of such assets. Tied with NABARD, the State government provides subsidy under this programme. The subsidy is up to 50 percent on shallow tube wells, dug-wells, bore wells and river lift projects limited to ₹ 20,000/-, ₹ 50,000/-, ₹ 50,000/- and ₹ 40,000/- respectively. During 2015-16, 6932 private lift irrigation points (PLIPs) which include 1501 STWs, 4316 deep bore wells, 1115 dug wells have been established under Jalanidhi-I by utilizing subsidy amounting to ₹ 3372.74 lakh and bringing 14000 hectares of additional area under assured irrigation.

(c) Other Programmes : Irrigation facilities have also been created through AIBP, Repair, Renovation and Restoration of Water bodies (RR&R), RIDF etc. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been launched during 2015-16 by Ministry of Agriculture and Farmers Welfare, Government of India with an objective to provide irrigation to all agricultural farms to "produce per drop more crop" and to achieve much desired rural prosperity.

(d) Major Highlights on Irrigation Projects in 2015-16 : The state government targeted to bring additional 10 lakh hectares of agricultural land under irrigation by 2019. Some major highlights of the ongoing irrigation schemes during 2015-16 are as follows:

1. 3 Mega lift irrigation projects namely Laitara and Utkela in Kalahandi district and Gudvella in Bolangir district have been commissioned to provide irrigation to 2750 hectares. Besides 55 mega lift projects with an estimated cost of ₹ 1736.15 crore have been started to provide irrigation to 67,180 hectares within 30 months.
2. Extension work of Upper Indravati Irrigation project completed.
3. 13796 Deep Bore Wells have been installed and handed over to beneficiaries by OLIC.
4. 953 Shallow Tube Well and 262 Micro River Lifts have been installed and handed over to beneficiaries by OLIC.
5. 1218 Community Lift Points have been installed and handed over to beneficiaries.
6. Revival of defunct LI points started in a mission mode, 1936 defunct LIPs repaired and irrigation potential of 40035 hectare created.
7. 1681 Check Dams and 45 incomplete MIPs have been completed.
8. 630 MIPs completed through GOI funding and State funded RRR scheme.
9. Field Channel and Field drain covering 97, 047 hectares and 29,311 hectares respectively have been completed.

Implements and Mechanisation

Farm mechanization has great significance for enabling farmers to take up timely and quality agricultural operations, reducing costs of production and improving productivity. Massive farm mechanisation programme has been taken up under State Plan Scheme. Popularisation of agriculture implements, equipments and diesel pump sets, RKVY, NFSM and Submission on Agriculture Mechanisation Schemes to popularise modern farm equipment and machineries. The Odisha Agro Industries Corporation Limited (OAIC) is functioning in the state since 1974. It is engaged in marketing of various agricultural inputs including agricultural machineries, equipment, implements through its network. Besides, the Corporation also executes shallow tube wells, bore wells and river lift irrigation projects for the farming community. It also provides other inputs such as fertilizers, pesticides and cattle / poultry feed to the farmers. During 2015-16, the Corporation has made a turnover of ₹ 527.15 crore against annual target of ₹ 608.66 crore. The machineries, equipments supplied under farm mechanisation are presented in Table 33 which exhibits a tremendous rise in demand for improved farm mechanisation and equipment.

Table - 33

Machineries Supplied Under Farm Mechanisation

(Supplied in No

Year	Tractor	Power tillers	Combined Harvester	Rotavator
2008-09	1500	5280	49	38
2009-10	2325	7615	72	36
2010-11	4750	12742	123	311
2011-12	9231	11257	78	96
2012-13	11085	12503	103	469
2013-14	11891	13032	399	4553
2014-15	10325	14388	264	4631
2015-16	11688	9166	407	5003

***Source** : Directorate of Agriculture and Food Production, Odisha*

The farm power consumption touched 1.60 KWH/hectare by the end of 2015-16. The year wise position explained under Table 34.

Table - 34

Farm Power Inputs in Agriculture

2003 -04	2004 -05	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16
0.67	0.69	0.73	0.77	0.82	0.90	1.02	1.12	1.24	1.32	1.32	1.48	1.60

***Source** : Directorate of Agriculture and Food Production, Odisha*

Table - 35

Disbursement of Crop Loan

Year	Crop loan disbursed
2010-11	5449
2011-12	8520
2012-13	8457
2013-14	12582
2014-15	12866
2015-16	15869

***Source** : Directorate of Agriculture and Food Production, Odisha*

Farm Credit

Since modern agriculture is capital intensive, farmer's access to farm credit is crucial in enhancing crop productivity, especially in Odisha's context. It encourages farmers to undertake new investments and adopt new technologies for more productivity. The crop loans and agricultural credit advanced by banks exhibits an increasing trend (Table 35) and

Table 36 and 36(A). The share of agricultural credit in total advance is around 29 percent against the national average of 18 percent.

Table - 36

Agricultural Credit Advanced

(Rs. in crore)

Year	Commercial Banks*	Co-operative Banks	Total
2011-12	3768.65	4751.02	8519.67
2012-13	5032.16	5421.99	10454.15
2013-14	4957.33	5230.55	10187.88
2014-15	6732.72	6804.75	13537.47
2015-16	9806.66	9469.14	19275.80

*Note : *Commercial Banks include RRBs*

***Source :** State Level Bankers Committee, Odisha*

Crop Insurance

Rashtriya Krishi Bima Yojana (RKBY) was introduced in the State from Rabi 1999-2000. Both Loanee and Non-loanee farmers have been covered under this scheme. It is compulsory for loanee farmers and optional for non-loanee farmers. The crops covered under this scheme are paddy, maize, groundnut, jute, niger, arhar, cotton during Kharif season and paddy, groundnut, mustard, potato during Rabi season. The year-wise achievements made under crop insurance are given in Table 36 (A) below.

Table - 36(A)

Year-wise Achievements made under Crop Insurance

Year	Type	Farmers covered (in lakh Nos)	Farmers paid compensation (in lakh Nos)	Sum insured	Premium collected ₹ in crores	Compensation paid ₹ in crores
2007-08	Kharif	8.41	0.66	1118	28.24	24.02
	Rabi	1.32	0.01	200	3.81	0.17
2008-09	Kharif	6.11	0.56	841	21.77	30.35
	Rabi	1.62	0.44	252	4.98	8.37
2009-10	Kharif	10.69	0.99	1575	39.7	46.9
	Rabi	1.35	0.21	259	4.65	6.5
2010-11	Kharif	11.83	2.27	1994.79	59.28	138.76
	Rabi	0.75	0.11	163.27	5.76	4.76

Year	Type	Farmers covered (in lakh Nos)	Farmers paid compensation (in lakh Nos)	Sum insured	Premium collected Rs. in crores	Compensation paid Rs. in crores
2011-12	Kharif	15.56	6.74	3072	94.42	673.94
	Rabi	0.83	1.4	241	5.38	1.4
2012-13	Kharif	14.78	1.15	3219.48	85.86	63.8
	Rabi	0.98	0.17	323.88	7.47	8.43
2013-14	Kharif	13.78	4.21	3539.81	91.69	458.36
	Rabi	0.1	0		0.92	0.14
2014-15	Kharif	18.01	1.76	5228.95	133.73	255.35
	Rabi	1.17	0.11	480.38	9.75	7.97

***Source** : Directorate of Agriculture and Food Production, Odisha*

Land Holding

Land holding pattern is a prime determinant of the production structure and socio-economic conditions in a society. Operational land holdings are classified as marginal, small, semi-medium, medium and large land holdings depending upon the area controlled in a single land holding. Distribution of operational holdings indicates that the total number of operational holdings has been increasing over the years but the area under holdings has been declining except for scheduled castes. As per 2000-01 agriculture census, the area of operational holdings of all social groups was 50.81 lakh hectares, which has declined to 50.19 lakh hectares in 2005-06 census and finally to 48.52 lakh hectares in 2010-11 census. The corresponding figures for scheduled caste stood at 5.14 lakh hectares, 5.26 lakh hectares and 5.65 lakh hectares respectively for 2000-01, 2005-06 and 2010-11, while for scheduled tribes the figures were 16.31, 17.48 and 16.15 lakh hectares respectively (Table 37 and 38).

TABLE - 37

District-wise Estimates of Operational Holdings for all Social Groups in Odisha, 2010-11

(Area in ha)

Districts	All Groups		Scheduled Caste		Scheduled Tribes	
	Nos.	Area	Nos.	Area	Nos.	Area
Angul	151450	146607	20014	15036	24496	21461
Balasore	285759	221581	61328	41492	2887	20144
Bargarh	193336	259515	28660	23938	44146	52801
Baudh	190915	170349	49189	37758	1752	20167

(a) National Mission on Oil Seeds and Oil Palm (NMOOP) : Government of Odisha have implemented the mission from the financial year 2014-15 with a funding pattern of 75:25 between centre and state for increasing the production and productivity of oilseeds and oilpalm crops. Under this mission, 3 mini missions are being implemented.

Mini Mission-I on Oil seeds

Quality oil seeds of groundnut, soyabean, rapeseed, sunflower, linseed, mustard, sesame and Niger are supplied at subsidized rates from the financial year 2014-15 under the scheme. During 2015-16, incentives have been provided to the farmers for production of foundation and certified seeds. 1600 quintals of foundation seeds and 1400 quintals of certified seeds have been procured and 1960 quintals of certified seeds were supplied to the farmers at a subsidy of ₹ 23.52 lakh. Besides, subsidy has also been provided to the farmers for popularising micro irrigation systems. Further, 40 Farmers Field School (FFS) on Integrated Pest Management have been conducted with an expenditure of ₹10.68 lakh and 100 farmers training school and 17 trainers training have been organised on various production technologies of oilseed crops. Also ₹ 100.32 lakh has been spent for conducting block demonstrations over 340 hectares on groundnut, 2004 hectares on mustard and 100 hectares on sunflower.

Mini Mission-II on Oil Palm

The main objective of this scheme is to provide subsidies for production of oilpalm seeding, maintenance cost for newly created Oil Palm plantation, micro-irrigation etc. with financial assistance from Government of India and State Govt. in the ratio of 75:25. During 2015-16 an area of 1744 hectares has been taken for Oil Plan Plantation and ₹ 8000/- has been provided to each farmers towards seeding cost and ₹ 4000/- per hectare for maintenance of old plantation in consecutive 4 years.

Mini Mission-III on Tree Borne Oil Seeds (TBOS)

It has been proposed to take up olive plantation in the state under Mission-III of NMOOP. Under the scheme, assistance will be provided to the farmers @₹ 48000/per hectare of taking up 200 numbers of plants per hectare and @₹ 3200/per hectare for maintenance of olive plantation and @ ₹ 1000/- per hectare for intercropping during the gestation period.

(b) National Food Security Mission (NFSM) : This is a centrally sponsored scheme launched in 2007-08 with the objective of increasing production of rice and pulses through expansion of area and enhancement of productivity of area and enhancement of productivity in a sustainable manner in the identified districts. As per the revised guideline of the Govt. of India, NFSM has five major components, such as,

1. NFSM-Rice
2. NSFM-Pulses

3. NFSM-Coarse cereals
4. NFSM-Commercial crops and
5. NFSM-Wheat

Except NFSM-wheat all the other components were implemented in the state from the financial year 2014-15. During 2015-16, NFSM-Rice has been implemented in 8 selected districts and NFSM-Pulsses in all 30 districts. The component-wise achievement details are given below.

1. NFSM-Rice : In order to increase the production and productivity of rice and to popularize the hybrid paddy cultivation among the farmers, demonstrations on hybrid paddy in the farmers' fields in 8 selected districts conducted in 36,500 hectares of the state. Cluster demonstrations were also conducted in 25,000 hectares. Cropping system based demonstration conducted over 8,000 hectares. Besides, during 2015-16, assistance was provided for the use of micronutrients over 4,232 hectares, plant protection chemicals and bio-grants over 40,658 hectares and weedicides over 6,551 hectare.

2. NSFM-Pulses : NFSM-Pulses was implemented in all districts of the state with a total expenditure of ₹1263.07 lakh (as on February 2016). During 2015-16, 11760 quintals of HYV pulse seeds were popularized, cluster demonstration on intercropping and improved varieties was taken up in 26,000 hectares.

3. NFSM-Coarse Cereals : Maize and Ragi are the two major coarse cereals of the state. NFSM - Coarse Cereals has been implemented from 2014-15 and the scheme coarse cereals and ISOPOM (Maize) have been subsumed under the scheme. The scheme has been implemented in 6 districts of the state during 2014-15. During 2015-16, demonstration of improved packages of maize and ragi conducted in 7,000 hectares.

4. NFSM-Commercial Crops : During 2015-16, ₹161.94 lakh has been spent for taking up various interventions for sustainable production of the commercial crops like cotton, jute and mesta.

(c) National Mission for Sustainable Agriculture (NMSA) : Under NMSA, components, namely Soil Health Management (SHM), On Farm Water Management (OFWM), Rain fed Area Development (RAD), Climate Change and Sustainable Agriculture Monitoring Modelling, Networking (CCSAMMN), Soil Health card and Paramparagat Krishi Vikas Yojona have been implemented which are outlined below.

Soil Health Management (SHM)

The objectives to maintain soil health through promoting use of soil test based recommendations, organic manures, integrated nutrient management besides conducting front line demonstrations and capacity building for sustainble crop production. During 2015-16, **₹ 393.76 lakh** has been received for establishment of 3 mobile and 3 static soil testing laboratories.

Soil Health Card

This component of NMSA has been implemented during 2015-16 with objective of providing soil testing results to the farmers in the form of "Soil Health Card". During 2015-16, 131488 Soil Health Card Shave been provide. With an expenditure of ₹ 249.58 lakh 26 farmers training have been conducted on effective use of Soil Health Card.

(d) Rain-Fed Area Development (RAD) : This component introduced appropriate farming system by integrating multiple components of agriculture like crop, horticulture, livestock, fishery, forestry with agro based income generating activities and value addition practices. 25 clusters of 15 districts of the state are included in the first year of implementation of RAD with the fund allocation of ₹ 13.00 crore during 2015-16.

(e) Paramparagat Krishi Vikash Yojana (PKVY) : This component of NMSA implemented in the state during 2015-16 with an objective of promoting organic farming through adoption of low cost eco-friendly technologies. ₹ 642.43 lakh has been received against the provision of ₹ 856.57 lakh and steps have been taken to adopt 120 clusters of 50 acres each under the programme.

(f) National Mission on Agriculture Extension and Technology (NMAET) : This is a centrally sponsored scheme with 4 submissions, namely-

1. Submission on Agriculture Mechanism (SMAM)
2. Submission on Agriculture Extension (SMAE)
3. Submission on Seed and Planting Materials (SMSP) and
4. Submission on Plant Protection and Plant Quarantine (SMPP)

A sum of ₹ 9641.23 lakh has been released for implementation of NMAET during 2015-16. Some components are explained below.

1. Submission on Agriculture Mechanisation (SMAM) : The schemes like "Macro Management of Agriculture" through which subsidy assistance for farm mechanization was provided, "Promotion of Agriculture Mechanisation through Training testing and Demonstration," and "Post-Harvest Management and Technology" have been subsumed under this submission, SMAM. During 2015-16, subsidy worth ₹ 1069.65 lakh has been extended to the farmers for purchase of different farm machineries and equipment. Assistance has also been provided for establishment of Farm Machinery Banks for custom hiring.

2. Submission on Agriculture Extension (SMAE) : The centrally sponsored scheme, "Support to State Extension for Extension Reforms", the Central Plan Scheme, "Capacity Building to Increase Competitiveness in Agriculture" and "AGRISNET project / National e-Governance Plan for Agriculture" have been subsumed under this submission SMAE. During 2015-16 a sum of ₹ 4190.55 lakh has been released for implementation of extension activities of the state including activities of ATMA.

(g) Rashtriya Krishi Vikas Yojana (RKVY) : This scheme was introduced by Government of India in 2007-08 with the objective of achieving 4 percent growth in agriculture and allied sectors. Generally, the state which maintained a higher ratio of expenditure in agriculture and allied sectors becomes eligible for assistance under the scheme. From the financial year 2015-16, Govt. of India categorised it under Centrally Sponsored Scheme with funding pattern of 60:40 between centre and state. RKVY aims at achieving ans sustaining desired annual growth by ensuring holistic development of agriculture and allied sectors. This scheme promotes development of Agriculture, Horticulture and other allied sectors like Animal Husbandry, Dairy development, Fisheries, Agriculture Research and Education, Minor/Lift irrigation and Watershed development. During 2015-16, a sum of ₹ 492.08 crore has been released by Government of India against an allocation of ₹ 554.54 crore. State level sanctioning committee sanctioned 123 nos. of new projects during 2015-16.

(h) Biju Krushaka Kalyan Yojana (BKKY) : To provide health insurance to the farmers, Biju Krushaka Kalyan Yojana (BKKY) has been introduced by State Govt. in 2013-14. It is an earnest effort to provide them financial support through health and accident insurance as a part of commitment of a welfare state. About 60 lakh farmers' families, irrespective of APL or BPL are eligible for this yojana, which promises insurance cover of ₹ 1.0 lakh annually to five members of a farmer's family. During 2015-16, about 57.66 lakh farmer families were enrolled under the scheme. Health insurance claims worth ₹ 16.61 crore have been claimed and 33,322 farmer families have received benefit.

(i) Odisha Watershed Development Mission : The state government has given priority to the development of rain fed areas in the state during 12th Five Year Plan. OWDM has also been designated as the state level nodal agency for implementation of the flagship programme, Integrated Watershed Management Programme (IWMP). The state aims to treat one million hectares area in cluster mode under the watershed development programme during the 12th plan. During 2014-15, 1.88 lakh hectares has been treated with different land and water management interventions, 14,546 hectares of cultivable wastelands have been brought under cultivation due to implementation of watershed activities.

(j) Integrated Watershed Management Programme (IWMP) : This programme was launched by the Department of Land Resources, GoI during the year 2009. The project covers 26 districts of Odisha except Puri, Jagatsinghpur, Kendrapada and Bhadrak. The main objectives of IWMP are to restore ecological balance by harnessing, conserving and developing degraded natural resources. IWMP projects are taken up in clusters covering an area of 5000-6000 hectares for realizing visible impact. Currently six batches of projects in 310 clusters have been sanctioned covering an area of 17.02 lakh hectares, with a project outlay of ₹ 2191.52 crore. Out of 310 projects, 243 are under implementation in 18 IAP districts covering an area of 13.28 lakh hectares with a project outlay of ₹ 1746.38 crore. Promotion of Community Based Organisations (CBO) is an important activity under IWMP. CBOs such as Self Help Groups (SHGs), Watershed Committees (WC) and User Groups (UGs) are organized strengthened for planning and implementation of different watershed projects. An amount of ₹ 19.09 lakh has been spent during 2015-16 (upto February, 2016). There exists a watershed committee in each micro-watershed covering an area of 500-1000 hectares. SHGs are engaged in micro-enterprise activities. During 2015-16, 917 SHGs have been formed with 11,004 members.

The Watershed Committee (WC) also constitutes User Groups in the watershed area, those who are responsible for operation and maintenance of all the physical assets created under the project. During 2015-16, 2310 UGs have been formed with 4,863 members and ₹ 536.02 lakh have been mobilized as WDF contribution from watershed activities. During 2015-16, 19,300 farmers, SHGs, UGs and CIG members have been trained on different aspects of self-employment and watershed management.

(k) Sustainable Harnessing of Ground Water in Water Deficit Areas (BKVY) : This programme was introduced in 26 districts of the state in 2010-11 and popularly known as Biju Krushak Vikash Yojana (BKVY) which has been implemented through Odisha Lift Irrigation Corporation under W.R. Deparment. Under this scheme, deep bore wells are being constructed in clusters of farmers' fileds which cover 5 hectares during Kharif and 2 hectares during Rabi season. During 2015-16, 13,798 bore wells have been energized.

(l) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) : The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been launched during 2015-16 by Ministry of Agriculture and Farmers Welfare, Government of India with an objective of access to some means of protective irrigation to all agricultural farms to "produce per drop more crop" to achieve much desired rural prosperity. PMKSY has 4 major components :

(i) Accelerated Irrigation Benefit Programme

(ii) Har Khet Ko Pani

(iii) Per Drop More Crop

(iv) Watershed Development

Odisha Watershed Development Mission (OWDM) has been designated as State Nodal Agency for PMKSY at state. Preparation of District Irrigation Plan (DIP) is mandatory for implementation of PMKSY. During 2015-16, DIPs of all districts have been prepared.

(m) National Horticultural Mission (NHM) : This is a centrally sponsored scheme launched in 2005-06 and activities have been extended to all the 30 districts of Odisha for development of 14 major horticultural crops. The main objective of the programme is to promote horticultural crops including fruits, flowers, vegetables and other crops. The funding pattern of the scheme between Government of India and Government of Odisha is 85:15

from 2007-08 before that it was 100 percent central assisted scheme. But from 2015-16 the funding pattern is 60:40 between Government of India and State. The scheme also supports post harvesting practices and marketing of horticultural crops to improve incomes of farmers The crops selected under the scheme include mango, citrus, litchi, banana, in fruits, cashew in plantation crops, ginger and turmeric in spices, betel vines and floriculture. The main thrust area of NHM during 2015-16 are :

(i) Fruit Orchard Development
(ii) Development of Floriculture
(iii) Human Resource Development
(iv) Vegetable Cultivation
(v) Protected Cultivation
(vi) Establishment of Marketing Infrastructure for Horticultural Produce
(vii) Integrated Post Harvest Management
(viii) Horticulture Mechanization
(ix) Cashew Plantation
(x) Integrated Coconut Farming

(n) Establishment of Regional Coconut Nursery : This scheme has been implemented under Mission for Integrated Development of Horticulture (MIDH) from 2014-15 with an objective of raising of coconut seedlings in Government Farms and Nurseries and sold to farmers at subsidized rates. During 2015-16, 10,000 coconut seedlings have been produced under this scheme.

(o) Special Crop Specific Scheme Floriculture : The scheme envisages achieving self-sufficiency in floriculture as well as generation of revenue for the farmers. Assistance has been provided to the floriculture farmers to take up rose, tuberose, marigold and jasmine for cultivation in their fields. During 2015-16, an amount of ₹ 34.28 lakh has been utilized for covering marigold in 20 hectares, tube rose in 13.5 hectares by end of February 2016.

(p) Coconut : The objective of the scheme is to increase area and production of coconut as the existing provision made under the Coconut Development Board (CDB) but production is not sufficient to meet the demad of the state. During, 2015-16, a sum of ₹ 370.54 lakh has been utilized to cover 1667 hectares under area expansion for coconut.

(q) Banana : The scheme envisages to make the state self-sufficient in banana production and to generate more profit for the farmers as the areas covered under existing schemes are not sufficient to cater to the demand of the state. It has been programmed to take up banana tissue culture plantation under the scheme to gives impetus to banana cultivation in the state. During 2015-16, an amount of Rs.141.47 lakh has been utilized for covering 160 hectares under the scheme.

(r) Betel Vine : As the farmers have to incur a huge expenditure during its initial period of its establishment, it is proposed to provide assistance to the tune of 50 percent of the 1st year establishment cost under the new scheme "Special Crop Specific Scheme - betel vine" under state plan with the objective to promote betel vine cultivation in the state. During 2015-16, 250 Borojs have been established and ₹ 82.00 lakh have been utilized by the end of February 2016.

(s) Development of Potato, Spices and Vegetables : In order to encourage farmers to take up cultivation of potato and other vegetables, quality seed materials were sold to the farmers at subsidized rate. During 2015-16, 5672.12 quintals of seed potatoes, 110.42 quintals of onion seeds and vegetable seeds at subsidised rate to 5 lakh farmers in moisture stressed area with the total expenditure of ₹ 63.57 lakh by the end of February, 2016.

INSTITUTIONAL SUPPORT

(a) Odisha University of Agriculture and Technology (OUAT)

OUAT, the second agricultural university in India, aims to develop technical manpower through quality based education, research and extension activities on agriculture and allied sciences in order to promote agriculture growth, productivity and economic condition of rural people. OUAT offers PG courses in 54 disciplines and Ph.D courses in 33 disciplines besides under graduate courses. The present intake capacity of OUAT is 1886. OUAT secured 3rd position in National Level ICAR-JRF Examination among 73 Agricultural Universities, OUAT's significant achievements during 2015-16 included the following activities.

The university enrolled 5045 students with 48 percent girl students. It undertook 51 national research projects and 67 ad hoc research projects of ICAR for all 10 agro climate zones of Odisha through its 8 Regional Research and Technology Tansfer Stations (RRTTS), 4 substations (RTTSS), 7 commodity research stations and 13 adaptive research stations. It collaborates with international rice research institutes of Philippines, Moscow, USA, Japan and Bangladesh. Out of 147 promising high yielding varieties of different crops developed by OUAT so far, 7 are released during 2015-16 with national and international acclamation. It released new 3 rice varieties ASHUTOSH, GOVIND and HASANTA, which are widely accepted by farming communities. The university has produced 1872 quintal breeder seeds, 3253 quintal foundation seeds and 78.10 quintal of nucleus seeds of different crops and vegetables, 67064 numbers of qualitative planting material of mango, cashew, medicinal plants, forest plants, vegetable seedlings were produced during 2015-16 which were distributed to Government Organizations, NGOs and interested farmers of the state as well as neighbouring states. OUAT developed integrated nutrient management and pest management modules, 2 suitable strains and growing techniques for different crops, multicoloured broiler poultry, value addition of tropical fruits like bale etc. Agricultural Technology Information Centre (ATIC) provides single door delivery of technologies, services and information and inputs immensely benefiting farmers.

(b) ICAR - Central Rice Research Institute (ICAR-CRRI)

ICAR-CRRI conducts basic, applied and adaptive research on crop improvement and resource management towards increasing and stabilizing rice productivity in different rice ecosystems, along with a special emphasis on rain-fed ecosystems and related biotic stresses. During 2015-16, one high yielding variety of paddy has been developed. The yield rate of this variety is 4.5 to 5.5 MT per hectare with 110 to 165 days duration.

(c) Agricultural Promotion and Investment Corporation Ltd (APICOL)

APICOL a promotional organisation is promoting commercial agri-enterprises, including agro-based and food processing industries in the state. During 2015-16, 161 Commercial Agri-Enterprises and 633 Agro Services Centres have been established with the capital investment subsidy of ₹ 39.45 crore by the end of February, 2016. APICOL is acting as the virtual office of Agricultural and Processed Food Products Export Development Authority (APEDA) under Ministry of Commerce and Industries, Govt. of India. The goal of APEDA is to maximize foreign exchange and provide better income to the farmers through exports. APICOL also acts as a state agency for Small Farmers Agri-Business Consortium (SFAC), a society under the Ministry of Agriculture, Government of India, to provide venture capital for qualifying projects of horticulture, floriculture, medicinal plants, etc. under agriculture and allied sectors. Under the scheme of infrastructure development, APEDA has sanctioned ₹ 528.35 lakh for setting up of an Integrated Pack House of fresh fruits and vegetables at Titilagarh in Bolangir district which is at the completion stage.

(d) Odisha Agro Industries Corporation (OAIC)

OAIC aims at marketing various agricultural inputs and farm machineries through a wide network of offices at district and sub-district levels. The corporation also executes tubewells, bore wells and lift irrigation points for farming communities. It provides inputs such as fertilizer, pesticides, cattle and poultry feeds to farmers. During 2015-16, the Corporation had a turnover of ₹ 527.15 crore against the target of ₹ 608.66 crore. So far, it has sold 339 tractors, 187 power tillers, 190 power reapers, 28179 diesel pump sets, 260 storage bins and 55,421 sprayers. Besides, it has also energized 148 bore wells, 2339 DLPs (Direct Lift Project). The Corporation also sold 102.31 thousand MT fertilizers and 5999 MT of gypsum and 25895 MT of seeds. The corporation has also produced and sold 908 MT of cattle feed during 2015-16.

(e) Odisha State Cashew Development Corporation (OSCDC)

During 1993, OSCDC Ltd. was declared as Nodal Agency to develop land, raise cashew plantation and other suitable species, render technical guidance and assistance to cashew growers and make available good planting materials. The corporation has established 19 numbers of cashew clonal nurseries and set up one medicinal plants nursery in Khurda district with assistance from National Mission on Medical Plant (NMMP) and started raising medicinal plants from 2013-14. During 2015-16, 21 lakh grafts of high yielding varieties cashew were produced and 17.52 lakh sold. Now, OSCDC has 604 cashew plantations over 28052 hectares covering 20 districts.

(f) Odisha State Seeds Corporation (OSSC)

OSSC has been designated as the Nodal Agency for production, procurement and supply of quality seeds to the farmers certified by Odisha State Seeds and Organic Products Certification Agency (OSSOPCA) under State Seeds Act. OSSCC has been implementing the

"Seed Village Programme" as "Mo Bihana Yojana" and providing incentives for production of quality paddy and non-paddy seeds. During Kharif 2015, an area of 20006 hectare were covered under seed village programme and expected to produce 6 lakh quintal quality certified seeds. Besides, OSSC has also procuring certified seeds from OUAT, MOU Farms, National Seeds Corporation and other agencies to meet farmers need. During 2015-16, 505923 quintals of seeds of different crops were supplied by OSSC.

New Initiatives - 2015-16

The Government have taken new initiatives such as promotion of gender friendly tolls for farm women in Odisha, special programme for millets in tribal areas, support to integrated farming system in tribal districts, System Development (revamp of the existing system on Training and Visit (T & V) model), grant to state procurement agencies, establishment of floriculture market, setting up of a company for marketing of fruits and vegetables, certification of agriculture programme, development of agriculture in collaboration with international agencies, introduction of solar pump sets and dug wells with diesesl / solar pump sets, support to farmers producers' organisation, agri-start up programme, corpus funds for fertilizers etc.

Types of Agriculture and Problems :

The types of agriculture practised in Odisha are -

1. Shifting Cultivation
2. Sedentary Farming
3. Subsistence Agriculture
4. Commercial Agriculture
5. Plantation Agriculture
6. Mixed Farming
7. Dairy Farming
8. Fruits or Vegetable Farming

1. **Shifting Cultivation :** This type of cultivation is seen in the tribal regions. The tribal generally burn the vegetation cover of a particular area on the sloping side of the hill and after the rainfall they cultivate the land. When the fertility capacity of the land is reduced the tribals shift from that place to a new place. Such type of cultivation is known as Shifting Cultivation. Different names are given at different places. In Odisha such type of cultivation is known as PODU cultivation. In South America and Indonesia such type of cultivation is known as MILPA and LADANG respectively. Due to burning of forest, serious problem like soil erosion and the less amount of rainfall result due to deforestation. So the awareness among the triblas regarding dangerous future effect of PODU is propagated by the government of Odisha through media and other means.

2. **Sedentary Agriculture :** Such type of agriculture is seen in the coastal regions, river basin and undulating plateau. A particular land is cultivated for years to-gather and paddy, maize, sugarcane etc are raised.

3. **Subsistence Agriculture :** With high yielding varieties of seeds and scientific method of cultivation of rice, wheat, jaw etc. not only provide required food sufficient for the family members of the farmers but also the farmers sell the surplus products.
4. **Commercial Farming :** Large scale scientific cultivation with high yielding varieties of seeds and appropriate fertilisers give rise to high production for commercial purpose.
5. **Plantation Agriculture :** Tea, Coffee, Coconut etc. come under plantation agriculture. At Thuamul-Rampur of Kalahandi district the plantation of tea and coffee is seen.
6. **Mixed Farming :** Cultivation along with rearing of animals is called Mixed Farming. Such type of farming has not developed in Odisha. In Western Countries large amount of foreign exchange is earned through the export of beef and mutton.
7. **Dairy Farming :** Such type of cultivation is done to supply fodders for cows and buffaloes in Western Countries which is absent in Odisha.
8. **Fruits and Vegetable Farming :** Such type of Cultivation in Odisha is seen near the urban areas.

Taking into consideration of rainfall and irrigation facility, agriculture of Odisha can be broadly divided into three categories as follows :

A. HUMID Farming
B. DRY Farming
C. IRRIGATED Farming

A. If the rainfall is more than 750 mm, then the region comes under Humid Farming.

B. If there is irrigation facility and the amount of rainfall is less than 750 mm, the region is known as Dry Farming region.

C. If there is irrigation facility both Rabi and Kharif crops are cultivated.

Reasons for Agricultural Low Productivity in Odisha or Problems relating to Agriculture :

1. Depleting soil conditions.
2. Great pressure of population.
3. Low amount of land per cultivation.
4. Shrinkage of agricultural area.
5. Uneconomic land holdings.
6. Lack of crop rotation measures.
7. Unpredictable nature of monsoon.
8. Lack of irrigation.
9. In adequate Banking and financing facility.

ANIMAL HUSBANDRY

The dependency syndrome on livestock sector of majority of rural people for their sustained employment and livelihoods is quite visible. Even about 85 percent of livestock are owned by the landless, marginal and small landholding families. Apart from providing a subsidiary income, rearing of livestock is a source of nutrition in the form of milk, egg and meat. As per Basic Animal Husbandry Statistics, 2014, Odisha ranks 11th among Indian States in egg production, 13th in meat production and 16th in terms of milk production (2014-15). Next to Agriculture, Animal Husbandry is the most important economic activity in rural areas. Though Odisha accommodates nearly five percent of the total bovine stock of India, its total contribution to NSDP is significant.

The livestock census, 2012 for all states is presented in Table 39. Uttar Pradesh had the highest livestock population in 2012. Odisha contributed about 4.05 percent population of livestock in the country compared to 13.42 percent in Uttar Pradesh, 11.27 percent in Rajasthan and 10.96 percent in Andhra Pradesh.

Table - 39

Major Statewise Total Number of Livestock and Poultry - 2012 Census

(in 000′ number)

State/UTs	Cattle	Buffaloes	Sheep	Goats	Pigs	Horses & Ponies	Mules	Donkey	Camel	Yaks	Mithun	Total Live Stock	Total Poultry
AP	9596	10623	26396	9071	394	5	1	13	0	0	0	56099	161334
Asam	10308	435	518	6167	1636	14	0	1	1	0	0	19082	27216
Bihar	12232	7567	232	12154	650	49	25	21	9	0	0	32939	12748
Chhattisgarh	9815	1391	168	3225	439	3	1	1	1	0	0	15044	23102
Gujarat	9984	10386	1708	4959	4	18	0	37	30	0	0	27128	15006
Jharkhand	8730	1186	583	6581	962	6	4	0	0	0	0	18053	13560
Karnataka	9516	3471	9584	4796	305	13	1	16	0	0	0	27702	53442
MP	19602	8188	309	8014	175	19	7	15	3	0	0	36333	11905
Maharashtra	15484	5594	2580	8435	326	37	2	29	0	0	0	32489	77795
Odisha	11621	726	1581	6513	280	3	6	1	1	0	0	20733	19891
Punjab	2428	5160	129	327	32	33	5	3	1	0	0	8117	16794
Rajasthan	13324	12976	9080	21666	238	38	3	81	326	0	0	57732	8024
Tmilnadu	8814	780	4787	8143	184	5	0	9	0	0	0	22723	117349
UP	19557	3062	1354	15586	1334	152	43	57	8	0	0	68715	18668
Uttaranchal	2006	988	369	1367	20	16	27	2	0	0	0	4795	4642
West Bengal	16514	597	1076	15506	648	4	0	1	0	1	0	30348	52838
All India	**190904**	**108702**	**65069**	**135173**	**10294**	**625**	**196**	**319**	**400**	**77**	**298**	**512057**	**729209**

Source : *18th Livestock Census, Departmental of Animal Husbandry, M/O Agriculture*

According to the livestock census 2012, the livestock population of Odisha was 207.33 lakh. Out of this , 59.56 percent were cattle and buffaloes, 38.39 percent were small ruminants, and 1.35 percent was pigs. Besides, the state has also 198.91 lakh poultry, as compared to 7292 lakh at all India level. Out of total poultry in the state, 70 percent was local backyard breeds. Livestock census 2012 also reveals that livestock population in the state declined by 10 percent over the previous livestock census, 2007, while it decreased by 3.33 percent at all India level. Table - 40 and 41 present the livestock population in Odisha under different census.

Table - 40

Censuswise Livestock Population in Odisha (lakh number)

Census year	Cattle Total	Cattle Cross breed	Buffaloes	Goats	Sheep	Pigs	Others	Total Livestock
2001	140.03	8.71	13.88	58.8	17.79	6.02	NA	236.52
2003	142.81	10.43	14.39	59.74	17.59	5.69	NA	240.22
2007	123.10	17.03	11.9	71.27	18.18	6.12	NA	230.57
2012	116.21	13.06	7.26	65.13	15.81	2.80	0.11	207.33

Source : Directorate of Animal Husbandry and Veterinary Services, Odisha

TABLE - 41

Cattle and Buffalo Population in Odisha as Per 2012 Animal Census

(lakh number)

Category	All Total		Female		Milch		Breedable	
	Total	C.B.	Total	C.B.	Total	C.B.	Total	C.B.
Cattle	116.21	13.06	57.99	9.86	30.83	5.29	33.98	5.71
Buffaloes	7.26	0	3.91	0	2.24	0	2.44	0
Total	**123.47**	**13.06**	**61.90**	**9.86**	**33.07**	**5.29**	**36.42**	**5.71**

Source : Directorate of Animal Husbandry and Veterinary Services, Odisha

Production and availability of Milk, Eggs and Meat in Odisha

Though India ranks first in the world in milk production, contribution of Odisha is less than two percent of the total production of milk (Table. 42). Egg production is about three percent of all India production. Production of milk increased from 1,282 TMT in 2004-05 to 1,938 TMT in 2015-16. The production of eggs has increased from 1216 million in 2004-05 to 1927 million in 2015-16. Details are given in Table 43. It is observed that though the per capita availability of milk has increased from 94 gms/day in 2004-05 to 118 gms/day in 2015-16, it is still far behind the all India per capita availability of milk. The targets

Livestock Health Care Services

Optimum health care management of the livestock resources are being taken up through the network of veterinary hospital dispensaries and live-stock-aid centres. There are institutions like Animal Disease Research Institute (ADRI) at Phulnakhara, Cuttack and one State Veterinary Laboratory (SVL) at Chiplima, Sambalpur. In addition, there are 26 Disease Diagnostic Laboratory (DDL) and 3 Central Investigation Laboratory (CIL) local at district/ regional headquarters for treatment and control of animal disease.

Mobile veterinary units are working in all blocks of the state for providing medical services to the farmers at their doorstep. During 2015-16, 156 MVU (Mobile Veterinary Units) have been in operation covering 61,459 villages, 15,61,308 cases treated and 14,04,096 vaccination done. National Animal Disease Reporting System (NADRS) is a computerized network connecting each block, district and state headquarters to the Central Disease Reporting Unit. The network connectivity at present is feasible to 307 nodes.

Livestock Breeding Farms

There are ECB/LBD farms in the state producing high pedigree bull calves to improve breeding and productivity of local animals through natural services/artificial insemination. The farms also produce and supply fodder and root slips to local farmers and propagate fodder cultivation programmes. In 2015-16 there were 491 animals comprising 112 milk producing cows, 83 dry cows, 118 heifers, 75 bull calves and 101 sucking calves maintained in these farms. About 3.11 lakh litres of milk was produced in these farms in 2015-16 against 2.94 litres of milk produced in 2014-15.

Bovine Breeding Policy

The State Bovine Breeding Policy has been approved by the Government on 29th September, 2015 for genetic up-gradation of cattle and buffaloes found in Odisha. It also helps enhancing the milk production which encourages farmers to accept dairying as their livelihood.

Artificial Insemination

Artificial insemination is an important component of dairy development and is being rendered through a network of 2985 departmental AI centres in the state. Apart from the departmental institutions, 1408 OMFED AI Centres, 684 JK trust AI centres, 100 BAIF centres and 1412 Gomitras are functioning in the state. Artificial insemination in the state is showing an increasing trend and special attention has been given for production of quality frozen semen for insemination purpose. This Frozen Semen Bank (FSB), located at Cuttack is the only semen producing station in the state, supplying semen to all the 30 districts. This Frozen Semen Bank has produced 9.24 lakh semen straws during the year 2015-16 (upto Feb-2016) to be used for artificial insemination and also awarded with ISO 9001:2008 and grade 'A' certificate for quality semen production by Government of India. Further, 14.28 lakh artificial inseminations were performed against the target of 16.41 lakh and 5.16 lakh progenies were born. Table 47 shows the status of artificial insemination programme in the state since 2005-06.

TABLE - 47

Status of Artificial Insemination Programme in Odisha (in lakh number)

Year	Target for AI	Achievement	Progeny Born
2005-06	7.77	6.548	2.77
2006-07	9.48	8.13	3.14
2007-08	12.00	8.94	3.66
2008-09	13.20	10.23	4.00
2009-10	14.73	11.66	4.29
2010-11	14.93	12.38	4.92
2011-12	15.78	12.23	5.19
2012-13	16.74	12.96	4.84
2013-14	17.50	14.35	5.29
2014-15	18.02	11.73	3.94
2015-16 (Feb-16)	16.41	14.28	5.16

***Source** : Fisheries & Animal Resources Development Department, Odisha*

Poultry/Duck Development

Poultry has been the fastest growing sector in providing employment and income to a significant number of people in the state. The backyard poultry also plays a vitral role in supporting livelihoods of million poor people particularly the tribal and the scheduled caste. Poultry Development Policy has been implemented in the state from 2015-16.

The achievement of Poultry Development Programme during 2015-16 is given below:

(i) There are 8 state poultry farms and 2 duck breeding farms functioning in the state under central assistance, having present parent stock capacity of 3,706 low input technology poultry birds and 1653 ducks. From these farms, 3.18 lakh numbers of day old chicks and 0.32 lakh of day old ducklings were supplied to interested farmers at reasonable price.

(ii) In order to boost backyard poultry in the state, assistance was provided to 1,113 BPL beneficiaries in selected 11 districts with centrally sponsored plan scheme under NLM.

(iii) About 72 commercial layer farms having 45 lakh birds producing 37.00 lakh eggs per day.

(iv) 5,172 broiler farms with commercial broiler bird strength of 86.00 lakh are in operation. Broiler placements are to the extent of 20 to 25 lakh day-old-chicks per week and 18 to 23 adult broiler birds are entering to the market for meat purpose.

(v) 48 number of district poultry hatcheries were established under the financial assistance of SGSY infrastructure fund to produce day old chicks to meet the demand of backward poultry rearing scheme in the state. Out of 48 hatcheries, 31 are functioning successfully and produced 4.5 lakh Day Old Chicks (DOC).

(vi) Under State Agricultural Policy, Capital Investment Subsidy given for setting up broiler farms and 3 layer farms in different districts of Odisha during 2015-16.

Fodder Development

Fodder is highly essential for animals which not only provide sufficient nutrient to the animals but also reduce the production cost significantly. The demand for green fodder and dry fodder in the state was about 312.04 lakh MT and 138.91 lakh MT respectively during 2015-16, against their availability is 161.22 MT and 106.21 MT respectively. There are 8 departmental LBD fodder farms covering an area of 127.30 acres which provided 24.18 thousand quintals of fodder during 2015-16 (Table 48). Besides, 18,419 mini kits and 35.17 lakh perennial roots and slips were distributed to farmers. The state had 13 fodder farms producing 2546 quintals of fodder and 4,52,000 root slips. Fodder Development Programme has been strengthened through State Plan schemes like Minikit Programme, Enrichment of Crop Residue and Departmental Fodder Farms etc.

TABLE - 48

Fodder Production in the Departmental L.B.D Farms, 2015-16

Name of the Farm	Area (in Ac.) for Fodder Production		Fodder Production (in Qtls	
	Target	Achievement	Target	Achievement
LBD Farm, Cuttack	6.00	6.00	3500.00	3613.08
ECB Farm, Chiplima	44.00	39.10	13200.00	5378.25
LBD Farm, Keonjhar	10.50	10.50	2847.00	2052.49
LBD Farm, Remuna	24.00	8.50	4020.00	1865.30
LBD Farm,Bhanjanagar	22.50	10.20	3480.00	3297.98
LBD Farm, Boudh	2.50	2.50	520.00	511.50
LBD Farm,Sundargarh	21.50	16.50	2956.00	3071.35
LBD Farm,Kuarmunda	35.00	34.00	4860.00	4388.50
ODISHA	**166.00**	**127.30**	**35383.00**	**24178.55**

Source : *Directorate of Animal Husbandry and Veterinary Services, Odisha*

Dairy Development

(a) Promotion of Dairy Entrepreneurship (PDE) : It has been intended to promote dairy entrepreneurs through provision of capital subsidy of 25 percent for general and 33.33 percent for S.C. and S.T. of total project outlay for establishment of dairy units. The objectives are to promote modern dairy farms, to up-grade traditional technology to handle milk on commercial scale, to generate self-employment and to provide infrastructure mainly for unorganized dairy sector. Under the scheme, 12,936 applications were sponsored out of which 2,859 disbursed during 2015-16.

(b) Interest Subvention on suppor for Dairy Farmers (short term and long term) : The scheme envisages facilitating credit linkage for dairy farmers to avail working capital loan under short term and long term. Farmers pursuing Dairy Farming as an income generating activity and availing short term loan were eligible for loan at subsidized rate of interest of 5 percent and additional 3 percent interest subvention will be made for prompt repayment of instalments in due time. The maximum limit of loan to be availed by the beneficiaries is ₹ 3.00 lakh at the rate of ₹ 20,000/- per cow. The maximum period for repayment of loan under the scheme is one year. During 2015-16, 75 applications were disbursed out of 537 and 462 were under processing.

Govt. also provides credit linkage for dairy farmers to avail term loan from banks for equipments, machineries, shed, procurement of livestock and other activities towards asset creation in dairy farming. Interest subvention of 3 percent of the interest rate is provided on term loan availed by the dairy farmers. Further, additional 2 percent interest subvention will be made for prompt repayment of instalments in due time. The beneficiaries who have availed dairy finance under PDE, DEDS and self-finance (except KSK) can avail interest subvention on long term credit support. During 2015-16, under this scheme 245 applications were disbursed out of 1,774 sponsored.

(c) Small Animal Development : The objective of the scheme is to enhance meat production by improving existing Small Animal Resources of the state through several inventions like genetic upgradation with supply of improved bucks and rams, health care measures including routine deworming and vaccination. There is 1 (one) sheep breeding farm, 5 (five) goat breeding farms and 1 (one) piggery breeding farm in the state to supply graded progenies to farmers for up-gradation of local breeds. These farms are being strengthened in a phased manner. There are 95 sheep, 374 goats and 107 pigs in these farms. During the year 2015-16, under "Genetic Upgradation Programme", a sum of ₹ 25.20 lakh was provided for strengthening of 7 numbers of small animal farms (sheep, goat and pig) to produce graded male, for enhancing production and productivity.

(d) National Mission for Protein Supplementation : This programme has been launched from 2011-12 in Odisha as a subsector under RKVY. The 'Goat scheme' has been implemented in 21 districts of the state with an objective of undertaking goat production as a profitable enterprise and promotes better health care and management for higher productivity and production. During 2015-16, 174 goat units have been assisted with 74,893 goats and provided subsidy to the tune of ₹199.66 lakh. Besides, 20 goat clusters have been identified and de-worming and vaccination support provided with an expenditure of ₹ 100.00 lakh.

(e) Integrated Livestock Development Programme (ILDP), Kalyani : The overall objective of the scheme is to provide gainful self-employment to the rural livestock keepers through dairy and livestock development programme. This project has four components viz.,

(i) Cattle development programme.

(ii) Goat development programme.

(iii) Fodder development programme.

(iv) Technology-knowledge and strategy partnership for development of Chipilima fodder farm.

Cattle development programme is being implemented in 10 (ten) districts. Doorstep livestock services are provided to the rural livestock keepers to breed the local cows by using superior dairy breeds. 100 cattle development centres have been established and 62,841 artificial inseminations, 134 infertility of heat synchronization camps conducted and 19963 progenies born under this project during 2015-16 (Jan, 2016). Comprehensive goat development programme has been undertaken in 5 districts viz., Sundargarh, Mayurbhanj, Keonjhar, Bolangir and Deogarh covering 25,000 farm families from 665 villages. Under this programme, 2234 breeding bucks have been provided to the goat keepers. De-worming done for 1.54 lakh goats, 1.11 lakh goats vaccinated against PPR and goat Pox and 656 goat farmers have been trained during 2015-16.

(f) OMFED : OMFED was established in 1980 as the apex body for milk procurement and marketing in Odisha. The main objective of OMFED is to promote, produce, procure, process and market milk and milk products for economic development of the rural farming community. It covers all the districts of the state. There are 5,281 Milk Producers Co-operative Societies (MPCS) with 2.68 lakh members under OMFED. Besides 12 milk unions covering all the districts have been affiliated to OMFED. OMFED has 13 dairy plants with 6.55 lakh litres capacity per day, 9 milk chilling centres with 1.95 lakh litres capacity per day, 345 bulk coolers with 5.41 lakh litres capacity, 1 milk powder plant with 5 MT capacity per day at Chandrasekhar Pur, Bhubaneswar and one cattle feed plant with 200 MT capacity per day at Khuntuni, Cuttack. During 2015-16, the federation has procured 5.26 lakh and marketed 3.92 lakh litres per day. In addition, it has also marketed milk products viz, ghee, paneer, butter, curd and milk powder and agriculture/organic products viz. turmeric powder and mustard seeds produced by tribes in Kandhamal district. Besides, OMFED has started producing fruit juice, pickles, jam, sauces and pineapple sip. The total turnover of OMFED during 2015-16 is ₹ 68,309.79 lakh which was more than 2014-15 i.e., ₹ 67,428.68 lakh. The important activities of OMFED are :

(i) Organization of Anand Pattern Dairy Co-operative Societies.

(ii) Procurement of milk from the rural milk producers from their door step through the Dairy Co-operatives at a remunerative price.

(iii) Chilling/Processing of procured milk as well as production of milk and milk products through the dairy infrastructures owned and managed by the federation as well as its affiliated unions.

(iv) Introduced icecream in different size and flavour to the range of milk products. Sale of milk and milk products to the urban consumers at an affordable price.

(v) Marketing agriculture and organic product i.e. Kandhamal Brand Turmeric Powder produced by the tribals of Kandhamal district.

(vi) Selling mineral mixture in 2 kg packet to remove vitamin deficient disease.

(vii) Training and orientation programme through its own training and demonstration centre.

(viii) Management of Fruit Processing Unit which produces different fruit juice, pickle and sauces.

(ix) By-pass protein plant and mineral mixture plant have been established in the campus of cattle feed plant.

(x) OMFED is operating the RKVY dairy projects in all the 30 districts of Odisha. Total outlay of this projects is ₹ 6,960.23 lakh.

(g) Odisha State Poultry Producers Co-operative Marketing Federation Ltd. (OPOLFED : OPOLFED, a state level apex poultry co-operative organization, functions at Bhubaneswar to popularize poultry products and develop a market for them. OPOLFED operates in two-tier system i.e. Primary Poultry Co-operative Society (PPCS) and Women Poultry Co-operative Society at grass root level and federation at the apex level. Presently, 33 PPCS/WPCS are affiliated to OPOLFED. OPOLFED has undertaken marketing of eggs and chicken, production of chicks and balanced premixed poultry. During 2015-16, OPOLFED sold about 42.40 lakh eggs valued at ₹ 2.98 crore, 69,632 kg chicken valued at ₹ 88.93 lakh and 420 M.T poultry feed valued at ₹ 96.93 lakh. During 2015, OPOLFED was opened fresh outlets at Sahid Nagar, IRC Village and OUAT campus in Bhubaneswar and also launching fresh chicken online shopping platform to enhance the market of OPOLFED.

Fisheries

Odisha being a maritime state, is endowed with rich potential of inland, brackish water and marine fishery resources. The state has a long coastline of 480 km with continental shelf area of 24,000 sq kms along the Bay of Bengal. It offers tremendous opportunities for development of fresh water, brackish water and marine fisheries with scope of fish production together with employment and income generation for socio-economic prosperity. In order to ameliorate these ample resources, Government has taken up a mission for doubling of inland fish production and tripling the present level of export. The total fish production of the state during 2015-16 is 4.69 lakh MTs and value of export generation is around ₹ 2069.17 crore, which is an all time record. Fresh water resources of the state are estimated to be 6.82 lakh hectares comprising of 1.31 lakh hectares of tanks/ponds, 2.0 lakh hectares of reservoirs, 1.80 lakh hectares of lakes, swamps and ponds and 1.71 lakh hectares of rivers and canals. The state's brackish water resources are 4.18 lakh hectares which include 0.79 lakh hectares of Chilika Lake, 2.98 lakh hectares of estuaries, 0.330 hectare of brackish water tanks and 0.081 lakh hectare of brackish water.

Odisha Fishery Policy, 2015

The State Government has come up with the Odisha Fisheries Policy, 2015 which offers tremendous opportunities for development of fresh water, brackish water and marine fisheries with scope of fish production together with employment and income generation for socio-economic prosperity. The policy aims at-

(i) Quantitative and qualitative appraisal of the fishery resources and their potential in the State of Odisha.

(ii) Enhancing the productivity and production of fish from inland, brackish water and marine resources and doubling the fish production in the next five years.

(iii) Tapping the untapped potential of aquaculture to contribute towards food and nutritional security.

(iv) Quality seed production in inland sector.

(v) Bridging the gap between the demand and supply of fish for domestic consumption

(vi) Harnessing the opportunity of expanding export markets for hig-value products

(vii) Capacity building, Technological intervention, Human Resource Development, Research and Development, Awareness building and Education of fisher folk and other stakeholders.

(viii) Upgradation of infrastructure facilities like Fishing Harbour, Fish Landing Centre (FLCs), cold chain, communication, etc.

(ix) Upgradation of the overall quality of fish with emphasis on hygienic post harvest handling.

(x) Encouraging public-private partnership investment across the sector.

(xi) Generating additional / supplementary employment opportunities in the rural sector for the fishers, educated unemployed youth and others.

Fish Production and Consumption in Odisha

Fish is a popular food item in Odisha. The state ranks 10th in terms of production of fish and produced 4.50 percent of the total fish production at all India level during 2014-15(P). During 2015-16, Odisha produced 521.28 TMT of fish of which 376.53 TMT came from inland sources and 144.75 TMT from marine sources. The inland fish production included 336.22 TMT from fresh waters and 40.31 TMT from brackish waters. Crab production has increased over the years. Fish production from Chilika has marginally increased to 12.05 TMT in 2014-15 to 12.24 TMT in 2015-16. The value of fish production in the state has increased by 24.43 percent over 2014-15. The value of inland fish increased by 31.72 percent whereas marine fish value declined by 5.66 percent. Out of total 521.28 TMT disposition of fish production, about 85 percent were marketed in raw form while 8 percent kept for sun drying and salting. The per capita fish consumption in the state is also showing an increasing trend. The per capita fish consumption in the state has increased from 8.70 kg. during 2004-05 to 12.24 kg during 2015-16 as against 11kg recommended by the WHO. This indicates an improvement of the standard of living and change in dietary pattern of the people of Odisha. Details regarding fish and crab production and per capita consumption of fish are given in Table 49. The source-wise fresh water fish production from 2004-05 to 2015-16 is given in Table 50.

of which 74.57 TMT (55.38 percent) were exported from marine sector. Generally marine products like frozen shrimp, frozen H.C. frozen pomphret, ribbon fish, etc. exported to foreign countries like Japan, China, USA, UK, UAE, Indonesia, Hong Kong. Export of frozen shrimps constitutes about one third of the total marine products exported every year. During 2014-15, 32,557 MT of frozen shrimp worth of ₹1744.00 crore was exported to foreign countries. The import of fresh water fish during 2015-16, was about 46.28 TMT. Yearwise import and export of fish is given in Table 51. The marine products export details are presented in Table 52.

TABLE - 51

Export and Import of Fish

(in 000' MT)

Year	Marine Fish	Fish export to other States and Countries		Total Export	Import of fresh water fish
		Fresh water fish	Brackish water fish		
1	2	*3*	*4*	5	6
2011-12	55.43	21.49	19.32	96.24	59.28
2012-13	69.45	26.34	20.62	116.41	21.22
2013-14	56.65	25.94	19.92	102.50	26.50
2014-15	65.69	24.56	25.37	115.62	38.12
2015-16(P)	74.57	24.30	28.86	127.73	46.28

Note : *(P) Provisional*

Source : *Directorate of Fisheries, Odisha*

TABLE - 52

Export of Marine Products to Foreign Countries

Year	Quantity (in 000′ MT)	Value (₹ in Crore)
1	2	*3*
2011-12	21.08	792.76
2012-13	23.69	908.48
2013-14	29.48	1769.45
2014-15	32.47	1963.85
2015-16(P)	35.63	1787.84

Note : *(P) Provisional*

Source : *Directorate of Fisheries, Odisha*

Inland Fisheries

The inland fisheries can be classified broadly into two categories :

(i) Fresh water fisheries.

(ii) Brackish water fisheries.

The fresh water fisheries sources comprise of 1,30,339 hectares of small and big tanks and ponds, 2,00,379 hectares of small (area above 10 ha.) medium and large reservoirs, 1,80,000 hectares of fresh water lakes, swamps and ponds and 1,71,186 hectares water area of rivers and canals. Similarly, the brackish water area comprises of 79,000 hectares of Chilika lake, 2,97,850 hectares of estuaries, 32,587 hectare of brackish water tanks and 8,100 hectares of backwater. Different ongoing schemes like production of quality spawn, development of reservoir fisheries and development of highland fisheries are being implemented through FFDAs. During 2015-16, for development of highland fisheries in the state, an amount of ₹ 492.57 lakh was spent under programme component like training and subsidy by the Govt.of India and State Government.

Fish Farmers Development Agency (FFDA)

FFDA is a Centrally Sponsored Scheme and implemented in all the 30 (thirty) districts of Odisha for promotion of pisciculture and providing technical and logistic support to fish farmers. By the end of 2015-16, about 70,064 hectares of tank area has been developed and 57,717 fish farmers were trained through these agencies. Further, 4281 fish farmers received benefits under this scheme.

Fresh Water Prawn Culture and Fish Seed

To meet the growing demand for quality fish seed, greater emphasis has been given for production of fish seed in five departmental hatcheries, 19 hatcheries of Odisha Pisciculture Development Corporation, 21 Departmental Farmers (FFDA), 105 hatcheries in private sector and 480 private Fry Rearing units. About 89.85 crore quality fries have been produced and sold to pisciculturists for stocking in their tanks during 2015-16. The spawn and fry production in government and private sector farms is as follows in Table 53.

TABLE - 53

Spawn and Fry Production in different Fish Farms

Year	Government	OPDC	Private	Total
Spawn Production (in lakh)				
2011-12	2315.50	7642.75	16803.00	26761.25
2012-13	3037.00	11735.50	13904.00	28676.50
2013-14	3487.00	9680.00	14704.00	27871.00
2014-15	3602.50	9616.25	20635.00	33853.75
2015-16	3588.00	8062.50	15864.00	27514.50
Fry Production in Odisha (in lakh)				
2011-12	994.49	1332.40	3813.86	6140.75
2012-13	738.85	2415.23	3865.28	7019.36
2013-14	1121.13	2388.27	3490.33	6999.73
2014-15	312.29	1172.41	4279.31	5764.01
2015-16	601.42	1612.31	5502.11	7715.84

Source : *Directorate of Fisheries, Odisha, Cuttack*

The State Reservoir Fishery Policy

The State Reservoir Fishery Policy has been formulated with a view to introducing scientific and remunerative pisciculture in reservoirs. The policy aims to attract private sector investment for augmentation of fish production from the vast untapped/under tapped reservoir resources through scientific manangement and permits the transfer of reservoirs having an area of 100 acres and above to the Fisheries and Animal Resources Department, Government of Odisha. The F and ARD department has been empowered to lease out these reservoirs to Primary Fishermen Co-operative Societies registerd under the Odisha Self-Help Co-operative Act-2001. Preference will be given to displaced persons/project affected persons under the policy.

Central Institute of Freshwater Aquaculture (CIFA)

The Central Institute of Freshwater Aquaculture began as the Pond Culture Division of the Central Inland Fisheries Research Institute, which was established at Cuttack, Odisha in 1949. The division was later upgraded as the Freshwater Aquaculture Research and Training Centre (FARTC) established at Bhubaneswar in 1976 with UNDP/FAO assistance. The functional existence of the institute came into effect from 1st April, 1987. CIFA gives proper direction and attention to such areas of research that would enable development of freshwater resources to obtain increased yield per unit area, thereby leading to higher aquaculture production from the cultivable/reclaimable ponds and tanks in the country. The institute has a comprehensive mandate of research, training, education and extension in different aspects of freshwater aquaculture. The following are the revised mandates of CIFA during 2014-15.

(i) To conduct basic, strategic and applied research in freshwater aquaculture.

(ii) To enhance production efficiencies through incorporation of biotechnological tools.

(iii) To undertake studies on diversification of aquaculture practices with reference to species and systems.

(iv) To provide training and consultancy services.

Research and Training by CIFA during 2014-15

CIFA undertook 14 institution-based and 25 externally funded research projects. It conducted 20 national level training with 334 participants and 1 international training programme with 2 participants in 2014-15.

CIFA Projects in Odisha

(a) With the largest freshwater farm comprising over 380 ponds of assorted sizes and yard facilities in the country at Kausalyaganga, Bhubaneswar, the institute is undertaking researches on carps, catfishes, freshwater rawns and molluscs.

(b) As a part of the Odisha monsoon contingency plan CIFA scientists have been visiting 5 districts, including Bolangir, Ganjam, Keonjhar, Nayagarh and Sambalpur and collected detailed information on agriculture crops, soil and water characteristics, rainfall and trend during the entire year. They had extensive discussions with district officials including collector, KVK staff and state fisheries officers. The institute has transferred seeds of aeromoniasis resistant selectively bred rohu to the Vijayawada RRC for on farm trials with a view to releasing the same to the farmers.

(c) Indian army-sponsored training for tribals from Assam on freshwater aquaculture conducted under the TSP programme at Bhubaneswar was a notable event of the reporting period. These hapless tribals are often caught in cross fire between militants and government forces; the skill development in aquaculture imparted to them would go a long way for their rehabilitation and economic support. ICAR-CIFA has signalled its entry to e-Governance by implementing Management Information System (MIS) including Financial Management System (FMS).

(d) The institute has also done water budgeting of carp culture ponds in Andhra Pradesh, West Bengal and Odisha.

Brackish-Water Fisheries Development Agencies (BWFDA)

BWFDA have been set up in seven coastal districts, abundant in brackish water sources. The state has a total brackish water area of 4.18 lakh hectares out of which 2,587 hectares is suitable for prawn culture. These agencies have developed about 18,160 ectares prawn culture area by the end of 2015-16. Brackish water prawn culture was ndertaken in an area of 8991.00 hectares and 23.343 MT brackish water shrimp was roduced during 2015-16. About 927 shrimp farmers have been benefitted and 272 farmers ained on modern shrimp culture techniques during. Around 24031 hectares of suitable overnment land have been identified for development of brackish water shrimp culture on ng term lease in future. Source-wise Brackish water Shrimp production is given in Table 54. Chilika lake with average water spread area of 906 sq kms in summer and 1,165 sq ms in monsoon and island area of 223 sq kms are the main sources of brackish water sheries in the state. The lake is surrounded by 132 fishermen villages with 22,032 families d 1,34,093 population. The fishermen actively engaged in fishing in the lake are around 4,536. Out of 170 registered co-operative societies, 150 are in operation with 39,534 shermen. There are 27 landing centres in which 11,836 MT of fish/shrimp and 398.77 MT abs were collected during 2015-16.

TABLE - 54

Source-wise Brackish Water Shrimp Production in Odisha

(in 000′ MT)

Year	Chilika lake	Brakish water shrimp	Estuaries	Total Production
2011-12	14.23	11.97	3.86	30.06
2012-13	12.47	13.23	4.22	29.91
2013-14	12.94	12.61	4.46	30.01
2014-15	12.05	19.25	4.07	35.37
2015-16	12.24	23.34	4.73	40.31

Source : *Directorate of Fisheries, Odisha*

Marine Fisheries

The state has 6 percent of the coastline and 4.7 percent of the continental shelf area of the country. Among six coastal districts, Puri has the longest coastline of 155 kms and Bhadrak the shortest with 50 kms. About 144.75 TMT of fish were caught from marine sector during 2015-16, of which prawn, catfish and pomphrets are some of the important species. The state has 73 marine fish landing centers. Odisha Maritime Fishing Regulation Act has been implemented in the state to safeguard the coastal water areas of the state. Registration/renewal of trawler licenses and conservation endangered species of fish and turtles are being taken up. Upgradation works of Dhamara fishing harbour and Balugaon fish landing center are under progress. Both fresh water and brackish water prawn culture have assumed considerable importance on account of their profitability as well as export potential. In addition, Govt, Shrimp hatchery at Chandrabhaga in Puri district and Gopalpur at Ganjam district and 12 other private shrimp hatcheries have been established at different areas of Gopalpur, Konark and Puri. Odisha has a total inland fisherman population of about 9.03 lakh according to the projected population estimates of 2016. Chilika region has the highest inland fisherman population of 1.48 lakh followed by Ganjam (1.09 lakh) Khurda (0.80 lakh) and Cuttack (0.76 lakh). Out of 9.45 lakh marine fisherman population in the state, Balasore has the highest population of 4.18 lakh followed by Kendrapara (2.29 lakh) and Puri (1.42 lakh) districts by 2016 (projected). Odisha has the highest number of 813 fishing villages among the coastal states. But it has fewer number of fish landing centres (73) as compared to 407 and 353 landing centres in Tamilnadu and Andhra Pradesh.

Fishermen's Welfare Schemes

There are 1,156 Primary Fishermen Co-operative Societies in the state, out of which 656 were operational during 2015-16 consisting of 1,38,092 members. Some of the ongoing welfare schemes for fishermen implemented in the state are :

Accident Insurance Scheme, Saving-cum-Relief, Matsyajibi Basagruha Yojana, Motorisation of Traditional Crafts, Biju Krushak Kalyan Yojana, Fishing harbours and FLCs for safe landing, Safety of Fishermen at Sea, Development of Model Fishermen Villages, Implementation of Marine Fishing Regulation Act, Enumeration of Coastal Fishers for issue of Biometric Identity Cards for security purposes, Assistance to fishermen for development of livelihood with Boat and Net. Benefits availed by Fishermen under welfare schemes in 2015-16 are explained below.

(a) Accident Insurance Scheme : A sum of ₹ 2.00 lakh is provided in the event of accidental death or permanent disability and upto ₹1 lakh is given in the event of partial disability. Further ₹ 10,000/- is allowed as assistant to fishermen towards hospitalization expenses during serious disease that keep them out from livelihood activities. In 2015-16 (upto December-2015), 11.50 lakh fishermen have been covered under this scheme with a compensation of ₹ 233.00 lakh.

(b) **Online Registration of Fishing Vessels and Development of Model Fishermen Village** : By the end of December 2015, 9320 country crafts, 7,578 motorized crafts and 1,755 mechanized crafts have been registerd online, to provide basic civic amenities like houses, drinking water and community hall to 20 selected houses in a village.

(c) **Safety to Marine Fishermen** : In the 1st phase, 1,53,000 Biometric Identity Cards and 470 numbers of Distress Alert Transmitters (DAT) have been distributed to selected fishermen of the state during 2015-16. In the second phase, 1,05,000 more cards have been distributed.

(d) **Saving-cum Relief and Motorisation of Traditional Crafts** : Under saving cum relief scheme, 7002 fishermen have been benefitted during lean period of fishing and to inculcate the habit of savings among them. Besides, 882 traditional crafts have been motorized with a subsidy of ₹ 448.79 lakh.

(e) **Matsyajibi Basagruha Yojana** : Under this scheme, poor and active fishermen were assisted to construct a dwelling house worth ₹90,000/- (₹75,000/- Government assistant + ₹15,000/- beneficiaries contribution). 1066 number of such dwelling houses have been allotted with a grant of ₹ 800.00 lakh as on February, 2016.

(f) **Biju Krushak Kalyan Yojana** : Under Biju Krushak Kalyan Yojana health insurance up to Rs.1.00 lakh has been provided to the fishermen families covering 5 members.

(g) **Rastriya Krishi Vikash Yojana (RKVY)** : Under RKVY programme livelihood support has been provided to the families affected by natural calamities. Construction of FRP boat/wooden boat/FRP sheathing on wooden boat in Marine/Chilika with 75 percent subsidy assistance subject to maximum ₹ 0.25 lakh in the norm. So far 4,538 boat and net have already been provided and ₹ 32.55 crore of subsidy has been distributed among the beneficiaries.

Fish Production at National and International Level

The total fish production in different states for the period 2011-12 to 2014-15 is shown in Table 55. During 2014-15 Andhra Pradesh tops the list with 1798.58 TMT followed by West Bengal and Gujarat, Odisha held 10th position at National Level, produced 469.54 TMT with 4.50 percent of the total fish produced in India during 2014-15. At international level China is the highest fish producing country followed by India, Indonesia and Peru. During 2011, fish production in India stood at 8,875 TMT, about 5.68 percent of the total fish production in the world (156195 TMT) China produced 54,393 TMT fish which is about 34.4 percent of the total world fish production during the same year.

TABLE - 55

Fish Production by Major States

(in 000' MT)

States / Union Territories	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	1603.17	1808.08	2018.42	1798.58
Gujarat	783.72	788.49	793.42	891.88
Karnataka	546.44	525.57	555.31	613.24
Kerala	693.21	679.74	708.65	726.01
Maharashtra	578.79	586.37	602.68	711.45
Odisha	381.83	410.14	413.89	469.54
Punjab	97.62	99.13	104.02	114.77
Tamil Nadu	611.49	620.40	624.3	697.61
Uttar Pradesh	429.72	449.75	464.47	494.27
West Bengal	1472.05	1490.02	1580.65	1617.32
India	**8666.49**	**9040.36**	**9578.97**	**10431.36**

FORESTRY AND ENVIRONMENT

Forests play a key role in maintaining ecological stability, reducing impact of natural calamities and checking soil erosion system. Different activities are being undertaken for protection, regeneration and extension of forest and tree cover in the state in participatory mode with involvement of local people for ameliorating the micro climate as well as environmental management and conservation. National Forest Policy 1988, Odisha Forest Sector Vison, 2020 and Joint Forest Management Resolution, 2011 provide guiding principles for forest management in the state. It ensures sustained livelihoods to forest-dependent communities which are mostly scheduled tribes. Forestry and logging sector contribute about 2 percent of real GSDP of Odisha.

Forest and Tree Cover

Odisha is endowed with rich forest cover and resources. The state forest areas in unevenly distributed that cover 37.34 percent of the state's geographical area. Forests are generally located in the districts situated in the Eastern Ghats, Central Table Land and Northern Plateau. The state has a recorded forest area measuring 58,136 sq km as on 2014-15. This includes 26,329 sq km (45.29 percent) of reserve forests, 15,525 sq km (26.70 percent) of protected (demarcated and un-demarcated) forests and 16,282 sq km (28.01 percent) of un-classed forests under government forest area. A total 12.29 sq.km of forests are under private ownership. The coastal districts with high population density have comparatively smaller areas of forests. The forest cover in 2014-15 was highest in Kandhamal district (9.8 percent) followed by Sundargarh (8.5 percent), Mayurbhanj (7.6 percent), Ganjam (5.4 percent) and Keonjhar (5.3 percent). The coastal districts such as Balasore, Bhadrak, Jagatsinghpur, Kendrapara and Puri have less than 10 percent of forest areas Forest Survey of India (FSI) makes satellite survey of actual forest cover of states every 2 years. The trend of actual forest cover (excluding tree cover) of Odisha by State of Forest Report assessment by FSI between 1991 and 2015 is presented in Table 56. During 2015-16, achievement under different afforestation programme was under AR-16576 hectare, ANR with gap 98540.08 hectare, ANR without gap 241975 hectare with total 357091 hectare and avenue and canal plantation of 4606.74 km was achieved.

TABLE - 56

Districtwise Forest Area

(in Sq. KM)

Name of the District	Geographical Area	Total Forest Area	Forest land under control of Forest Department		Forest land under control of Revenue Deptt.		
			Reserve Forests	Unclassified Forests*	Demarcated Protected Forests (DPF)	Undermarcated Protected Forests	Other forests Under Revenue Deptt.
Angul	6375	2716.82	1760.76	1.15	273.21	11.99	669.71
Balangir	6575	1543.85	1105.68	0.14	3.63	0	434.4
Balasore	3806	332.21	202.69	0.19	21.54	0	107.79
Bargarh	5837	1216.13	583.52	0.13	451.19	0	181.29
Bhadrak	2505	97.07	0	0.01	3.96	32.98	60.12
Boudh	3098	1277.17	983.33	1.02	43.48	0	249.34
Cuttack	3932	787.9	522.39	0.45	101.41	0	163.65
Deogarh	2940	1560.22	578.4	0.04	243.86	0	737.92
Dhenkanal	4452	1737.62	1141.02	0.04	13.78	0	582.78
Gajapati	4325	2468.98	416.89	0.13	108.15	1149.41	794.4
Ganjam	8206	3149.9	1485.69	0.86	143.54	1167.36	352.45
Jagatsinghpur	1668	132.92	1.23	0.02	4.77	83.06	43.84
Jajpur	2899	725.27	6.35	0.01	299.32	0	419.59
Jharsuguda	2081	202.44	35.53	0.04	109.97	0	56.9
Kalahandi	7920	2538.01	1449.03	0.54	488.51	313.37	286.56
Kandhamal	8021	5709.83	2010.06	2	1783.3	0	1914.47
Kendrapara	2644	248.05	14.49	4.5	127.57	62.32	39.17
Keonjhar	8303	3097.18	1834.09	0.26	273.64	220.79	768.4
Khurda	2813	618.67	298.81	0.68	209.87	0	109.31
Koraput	8807	1879.53	478.86	0.68	984.58	0	415.41

Name of the District	Geographical Area	Total Forest Area	Forest land under control of Forest Department		Forest land under control of Revenue Deptt.		
			Reserve Forests	Unclassified Forests*	Demarcated Protected Forests (DPF)	Undermarcated Protected Forests	Other forests Under Revenue Deptt.
Malkangiri	5791	3355.88	352.44	0.3	940.61	661.92	1400.61
Mayurbhanj	10418	4392.13	3330.14	2.2	245.06	0	814.73
Nuapada	3852	1849.69	0	0.44	1504	0	345.25
Nayagarh	3890	2080.97	1301.99	0.25	188.03	135.58	455.12
Nawarangpur	5291	2462.73	535.34	0.07	685.77	0	1241.55
Puri	3479	137.1	15.66	0.51	85.88	0	35.05
Rayagada	7073	2812.33	771.62	0.96	1147.19	0	892.56
Sambalpur	6657	3631.77	2151.71	1.18	363.01	0	1115.87
Sonepur	2337	415.78	309.52	0.03	0	0	106.23
Sundargarh	9712	4957.32	2651.88	1.72	836.85	0	1466.87
Odisha	**155707**	**58135.47**	**26329.12**	**20.55**	**11685.68**	**3838.78**	**16261.34**

***Source** : PCCF, Odisha*

(Forest Deptt. Buildings, roads, nurseries etc.)*

State Forest Report 2015 by Forest Survey of India is released in December 2015. The major highlights of the FSR, 2015 for Odisha is given in Box.

Forest Survey Report (FSR), 2015

- Out of the sixteen major forest type groups in India, four major forest types that exist in Odishaare : Tropical Dry Deciduous Forests (57.87 percent), Tropical Moist Deciduous Forests (39.88 percent), Tropical Sem Evergreen Forests (0.68 percent) and Littoral and Swamp Forests (0.48 percent).
- Plantations/trees Outside Forests (TOF) in Odisha constitute 2.56 percent of the total Geographical area of the state. The actual forest cover of Odisha in 2014-15 was 50354 sq km, which constitutes 32.34 percent of the state's geographical area in terms of forest conopy density classes. The corresponding figure of 2013 was 50347 sq km. Thus, the actual forest cover increased by 07 sq km from 2013 to 2015. This increase in forest cover is due to conservation measures and improvement in mangrove areas and plantation activities area by State Forest Department.
- The state has 7023 sq km of 'Very Dense Forests' (VDF) will crown density above 70 percent, 21470 sq km 'Moderately Dense Forests' (MDF) with crown density ranging from 40-70 percent and 21861 sq km of 'Open Forests' (OF) with crown density ranging from 10-40 percent assessed separately.
- Tree cover Outside Forests (TOF), assessed separately, is 3986 sq km. The VDF, MDF, OF, TOF, Scrub and non-forest area constitute respectively 4.51 percent, 13,79 percent, 14.04 percent, 2.56 percent, 2.89 percent and 64.72 percent of the total geographical area of Odisha.

- Mangrove cover increased to 231 sq kms in 2015, a rise by 8.45 percent over 2013.
- The actual forest and tree cover together constitute 34.90 percent of total geographical area of the state.
- The state's forest and tree cover shares 6.84 percent of India's forest and tree cover. Per capita forest and tree cover of Odisha is 0.130 hectare as per 2015 SFR estimate.

Forest Area Diversion

By 2015-16 (As on 1.10.2015), 433 diversion proposals covering an area of 46,708 hectares were diverted under the Forest Conservation Act, 1980 for different development projects. Out of these, 162 proposals relate to mining sector alone covering an area of 21,256 hectares, 83 proposals are of irrigation sector covering an area of 9713 hectares and the balance 188 proposals covering an area of 15739 hectares are for other sector such as industry, energy, railway, road and bridges etc. During 2015-16, seven project proposals have been approved for diversion of 756 hectares of forest area. This diversion of forest area to non forest use sharply reduced in 2015-16 as compared to a much larger forest area diversion of 2868 hectares for 21 projects of non forest uses in 2014-15. Besides 49 hectares of forest land have been diverted under General Approval by the State Government under Forest Conservation Act 1980 for different development projects in LWE districts. In the last 11 years between 2005-06 and 2015-16, the establishment of 176 projects of non forest uses resulted in diversion of 17065 hectares of forest areas in the state. The following Table 57 explain the year-wise forest area diversion.

TABLE - 57

Forest Area Diverted to Non-forest Use (2004-05 to 2015-16)

Year	Number of Projects	Area diverted to non-forest use (in hectare)
2004-05	9	1274.39
2005-06	28	2207.23
2006-07	17	911.83
2007-08	20	1802.58
2008-09	14	723.74
2009-10	15	2310.16
2010-11	13	915.95
2011-12	13	831.18
2012-13	10	2813.74
2013-14	18	925.407
2014-15	21	2867.588
2015-16	7	756.0094

Source : *PCCF, Odisha*

Afforestation Programme

Afforestation : A series of state and centrally sponsored afforestation programmes are being implemented in the state to combat the degradation of forest area occuring due to economic and developmental activities. Compensatory afforestation assumes vital importance for the state. Whenever a proposal for diversion of forest land for non-forestry purpose is approved by Central Government, there is a stipulation to raise compensatory afforestation over equivalent non-forest land or over twice the degraded forest land. Compensatory afforestation has been raised over 10,742 hectares by the end 2015-16. Achievements under different afforestation programme from 2010-11 to 2015-16 are shown below.

TABLE - 58

Achievements under Different Afforestation Programme, 2010-11 to 2015-16

(area covered in Ha.

Programme	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Economic Plantation	1800	2000	2050	2100	2300	2300
Compensatory Afforestation	4285	4188	4325	2114	5464	10741.6
National Afforestation Programme through FDA,s	2784	2240	2083	1875	4910	4590
Odisha Forestry Sector Development Project	78220	25745	13677	3410	14247	-
Industrial Plantation	290	55	12	–	–	-
National Bamboo Mission	1040	1023	2083	1545	2915	-
NREGS and Other Schemes	9543	146935	83057	93889	169055	28354
Avenue Plantation (Running Kilometers RKMs)	241	769	3107	4506	4755	4606

***Source :** Chief Wildlife Warden Odisha*

Production and Revenue Collection

Odisha produces 11 percent of the country's Kendu leaf production. Odisha is the third largest producer of Kendu Leaf (KL) next to Madhya Pradesh and Chhattishgarh. The annual production of kendu leaf in the state is around 4 to 4.5 lakh quintal. Sundargarh, Angul, Deogarh, Kalahandi, Keonjhar, Kandhamal, Malkanagiri, Nawarangapur, Koraput, Dhenkanal, Jharsuguda, Sambalpur, Baragarh, Bolangir, Sonepur, Boudh and Nuapada are the main kendu leaf producing districts. During 2015, kendu leaves for qtl. 375.80 thousand with sale value of ₹ 541, 92.11 lakh and during 2016 a total quantity of qtl. 220.71 thousand with sale value of ₹ 503,49.37 lakh were produced and handed over to OFDC for marketing. About 150 lakh person days of employment generated under different kendu leaf operations. The procurement price of green kendu leaves was enhanced from 35 paise to 60 paise per kerry (i.e., a bundle comprising 20 leaves) from 2014.

TABLE - 59

Production and Revenue Collection from Forest Products by OFDC

Item	Unit	2014 - 15			2015 - 16		
		Production	Quantity Sold	Revenue Collected (₹ in crore)	Production	Quantity Sold	Revenue Collected (₹ in crores)
Timber and Product (Round & Swan)	Cum	48170	33047	73.67	60466	45114	96.33
Fire wood	MT	32367	28306	8.93	32247	33553	11.33
Bamboo	SU	3964.53	23973	5.45	19151	8507	3.00
Kendu leaf	Lakh qtls.	3.96	4.08	390.73	3.76	4.09	554.4

Source : Odisha Forest Development Corporation (Director Operation)

Odisha Forest Development Corporation Limited (OFDC)

OFDC, a wholly Government of Odisha undertaking, has created enduring value by ecuring sustainable and scientific forestry, greening of landscape, meeting people's requirement f timber, firewood, bamboo also promoting forest based industries and creating employment pportunities. OFDC is a debt free and profit earning PSU which has been evaluated as an "Excellent Category PSU". OFDC trades mainly in timber, kendu leaf, bamboo, sal seeds and ther non-timber forest produce and supply timber and firewood to the people and industries rough its 136 depots. Total outrun of timber of OFDC during 2015-16 was 60466 cum 59133 round + 1333 swan), and firewood was 32247 M.T. The Corporation sold 45114 um timber and 33553 MT firewood valued at ₹ 96.33 crore and 11.33 crore respectively uring 2015-16. It has undertaken extraction of harvestable bamboo through the Raw Material Procurers (RMP) appointed by the Government. Bamboo production in the same year stood t 19,151 sale units and corporation earned ₹ 3.00 crore from bamboo trading. Production nd Revenue collection from different forest produce during 2015-16 is reflected in Table 59.

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

The scheme is in operation since 2006-07. By the end of 2015-16, (Dec-2015) fforestation has been done in 28,354 hectares. Besides, AR plantation was raised in over 109 running kms and 26,245 hectares of ANR with gap plantation during the period. uring this period, 123.60 lakh saplings have been planted and 3340 RKM avenue plantation done.

Odisha Bamboo Development Agency

Odisha Bamboo Development Agency (OBDA) has been formed to promote the amboo sector in the state with special focus on commercial cultivation of bamboo in private and, thereby promoting sustainable livelihood for tribal and rural poor with special emphasis on women empowerment. Since inception of the OBDA in 2006-07 till 2015-16, total bamboo plantation has reached over 13,042 hectares both in government and private land. Odisha has 9 percent of the country's total bamboo forest cover and 7 percent of total growing stock of bamboo. Bamboo in forest areas of the state grows as a mixed crop associated with sal and other species. The mixed bamboo forest area is spread over 17,795 sq km, while pure bamboo forests, occurring mostly as bamboo brakes and is about 375 sq km. The production of bamboo is approximately 2 lakh MT annually of which about 50,000 MT is produced from private lands. The cultivated species (i.e., Bambusa vulgaris and Bambusa nutans) are grown mainly in Mayurbhanj, Balasore and Bhadrak districts. The major achievements of the OBDA during 2015-16 include :

(i) Revival of 64 old nurseries.

(ii) Raising of bamboo plantation over 368 hectares of forest area, 628 hectares of non-forest private land and in 15 hectares non-forest govt. land.

(iii) Improvement of 51 hectares of existing stock in private land and provision of micro irrigation of 21 hectares by farmers.

(iv) Organisation of 36 farmers' trainings, 12 artisan training programme and 6 domestic trade fairs and exhibition.

Forest Protection and Management

With growing population, there has been tremendous pressure on the forests, both for forest produce as well as for forest land. Protection of forests and wild life is one of the most important mandates. The state is divided into 282 Ranges, 1001 Sections and 3,136 Beats. The average forest area per Beat comes to 18,54 sq. kms, per forest section, 58.8 sq. kms and per Range 206.15 sq. kms. It is quite high from the management point of view. During 2015-16, 60,299 forest offence cases have been booked, 2,172 persons have been arrested and 2680.04 cubic meter of timber and 705 non-motorised and 681 motorized vehicles have been seized.

The following measures have been taken to strengthen the forest protection during 2015-16.

(i) 208 forest check gates set up at vulnerable transit points all over the state for checking illegal transportation of forest produce.

(ii) 19 APR units deployed in 19 forest divisions to assist forest staff in protection activities.

(iii) There are 590 VHF stations and 880 walktalkies operational in the state for strengthening communication network for monitoring protection activities.

(iv) 354 kms of forest have been maintained, 25 culverts, 102 causeways have been constructed to facilitate mobility for forest/wildlife protection.

(v) Rewards are being given to informers, staff, public etc. as per "Reward for Detection of Forest Offence Rule, 2004" to encourage them to co-operate in forest protection activities.

(vi) 82 vehicles (four wheelers) and 42 motorcycles have been purchased out of CAMPA funds for exclusive use in forest protection in vulnerable areas.

(vii) 91 forest protection squads, 65 para forest staff unit and 216 fire protection squads constituted under different schemes involving 910 nos. 1950 nos. and 2,160 nos. of local youths respectively for forest protection activities in different forest divisions.

(viii) 12,513 Vana Surakshya Samities (VSS) formed and assigned with a total forest area of 11,69,748 sq.kms. for protection.

(ix) 506 Eco-Development committees have been formed to protect forest and wild life.

Odisha Biodiversity Board (OBB)

Odisha Biodiversity Board (OBB) functions since 2009 in Odisha under the legal provision of Biological Diversity Act 2001, envisages conservation of biodiversity, sustainable use of its components and fair and equitable sharing of benefits arising out of use of biological resources and associated traditional knowledge. The physical achievements of OBB during 2015-16 include :

(a) Implementation of Biological Diversity Act, 2002.

(b) Constitution of Biodiversity Management Committee (BMC).

(c) Preparation of People Biodiversity Register at Gram Panchayat level.

(d) Capacity building for forest Officials and BMC members.

(e) Organisation of National and State level Conferences, Media Publicity, Research and Development Projects, Publications etc.

(f) Celebration of International Biodiversity Day, 2015.

Compensatory Afforestation Fund Management and Planning Authority (CAMPA)

State Compensatory Afforestation Fund Management and Planning Authority (CAMPA) programme constituted in 2009, aims at conservation, protection, regeneration and management of existing natural forests, wildlife and their habitat and raising site specific compensatory afforestation, penal compensatory afforestation etc. CAMPA so far formulated 6 Annual Plans of Operation and 2 Additional Annual Plan operation so far since 2009-10. During 2015-16, following activities under CAMPA were undertaken :

(i) Compensatory afforestation.

(ii) Conservation, regeneration and management of natural forests.

(iii) Forest protection.

(iv) Control and prevention of forest fire.

(v) Infrastructure development.

(vi) Wildlife management.

(vii) Monitoring mechanism

State Medicinal Plant Board

The State Medicinal Plant Board has taken up the following activities during 2015-16.

(i) Created awareness on conservation, use, cultivation and marketing of medicinal plants.

(ii) Conducted State Level and Regional Level Kalinga Herbal Fairs at Berhampur and Nuapada.

Wildlife Census, Ecology and Environment

Odisha with its diversified topography and climate has been the abode of rich biodiversity and a variety of wildlife species.

(a) Wild Life Sanctuaries and National Parks : The total protected area in the state is 8352.19 sq km, which constitutes 5.36 percent of the total geographical area. There are nineteen wildlife sanctuaries, one national park at 'Bhitar kanika', one wildlife sanctuary at Kapilash in Dhenkanal district, One Zoological Park at Nandankanan, Bhubaneswer and 2 mini zoos. Besides, there are two tiger reserve and three elephant reserve in the state. Similipal will be declared as national park very soon. Similipal has dense forests and hills and is home to a wide variety of wild animals, reptiles and birds. Bhitarkanika is a wetland and one of India's finest coastal ecosystems. It has rich mangrove area on the deltaic region of the river Brahmani and Baitarani and is crisscrossed by creeks and rivulets. After Sundarbans, it is home to the second largest mangrove 'forest' in India. UNESCO has bestowed the world heritage status to Bhitarkanika.

(b) Tigers and Elephants Reserve : Odisha has two 'notified' tiger reserves; the Similipal Tiger Reserve in Mayurbhanj district and the Satakoshia Tiger Reserve in Angul district. With the help of new technique of Camera Trap method introduced by National Tiger Conservation Authority (NTCA) and Wild Life Institute of India (WLI) scientists calculated the presence of 45 tigers during January 2006 to February 2008. This number has come down to 28 in the census undertaken during 2014-15 which further increased to 40 during 2015-16. Leopard population in the state was recorded at 318. There are 3 Elephant Reserves in the state, located in Mahanadi and Sambalpur. Elephant population during 2010-11 was 1886, which increased to 1930 during 2012-13 in 2014-15 it is recorded as 1954. All Odisha Elephant census, 2015 conducted throughout the state.

(c) Turtles : The mass nesting sites of Olive Ridley sea turtles are located at Gahiramatha Sanctuary. During 2015-16 nesting season 0.52 lakh Olive Ridley Sea Turtles visited Odisha coast for mass nesting as against 4.13 lakh in 2014-15. At Rushikulya River mouth 3.09 lakh turtles nested in the year 2014-15. The State Government is giving top priority for the safety of these turtles. Under Integrated Coastal Zone Management Project, 10 river squads at Bhitarakanika and 2 patrolling boats at Rushikulya have been engaged for protection of Olive Ridley sea turtles.

(d) Migratory Birds : The winter welcomes many avian guests to Chilika, Bhitarakanika and other water spread areas in the state. Chilika lagoon receives over 7.5 lakh birds every year. Nalabana, island inside Chilika lagoon is an abode of avifauna and becomes a paradise for the migratory birds in winter. Avian species like pintail, gull-billed tern, common sand pipers, bar headed geese, grey leg geese, spotted eagle and osprey are some of the species of migratory birds. The census conducted for migratory birds in 2015-16 reflects that 8.39 lakh birds of 94 species, 1.06 lakh birds of 131 species and 0.96 lakh birds of 60 species visited Chilika lagoon, Bhitarakanika mangrove wetlands and Hirakud Reservoir respectively. Increased awareness, improved protection measures and surveillance have reduced hunting of these birds. Different wildlife species in the forests of Odisha for the year 2010-11 to 2015-16 has been depicted in Table 60.

TABLE - 60

Wildlife Census in Odisha

Sl	Species	Census & Site	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1	Salt water	Bhitarkanika	1670	1659	1661	1665	1678	1683
2	Mugger Crocodile	Satkoshia/Mahanadi	91	81	76	90	86	103
		Similipal Tiger Reserve	85	82	80	79	81	79
		Ghodahada Reservoir, Digapahandi, Ganjam	–	40	48	46	49	55
3	Gharial	Mahanadi River System	03	6	6	02	01	03
4	Olive Ridley sea turtle	Gahirmatha (in lakh)	4.72 lakh	1.68 lakh	4.06	–	4.13 lakh	0.52
		Rushikulya river mouth (in lakh)	2.52 lakh	4.01 lakhs	2.88	0.60	3.09 lakh	0
		Total (lakh no.)	7.24	5.69	6.94	0.60	7.22 lakh	0.52
5	Irrawaddy Dolphin	Chilika lagoon	156	145	152	158	144	–
6	Dolphin	7 species					450	450
7	Blackbuck	Balukhand-Konark Wildlife Sanctuary	34	13	22	–	3806	–
		Balipadar-Bhetnoi area in Ganjam district	1281	–	–	–		–
8	Elephant	Entire state	1886	1930	1930	–	1954	1954
9	Tiger	Entire state	32	–	–		28	40
10	Leopard	Entire state	–	–	–	–	–	318
11	Migratory Birds	Chilika lagoon	7.92 lakh 103 species	8.68 lakh 106 species	8.62 lakh 112 species	7.07 lakh 99 species	7.46 lakh 102 species	8.39 lakhs 94 species
		Bhitarkanika Mangrove	0.53 lakh 107 species	0.53 lakh 118 species	0.82 lakh 111 species	0.67 lakh 142 species	1.13 lakh 145 species	1.06 lakhs 131 species
		Hirakud Reservoir	0.11 lakh 34 species	0.47 lakh 52 species	NA	0.64 lakh 54 species	0.58 lakh 64 species	0.96 lakhs 60 species

Source : PCCF Wild life

Man Animal Conflict

Because of accelerated developmental activities and promotional aspects of industries added with biotic pressure has created a challenge for protection of wildlife and its habitat, as a result human and wildlife conflicts occur quite often. Men - animal conflict has been an increasing concern for Odisha in recent years. Depletion of dense forest areas has led to life and food insecurity of wild animals, elephants to be specific. Death and injury of people and domestic animals, mass damages of houses and crop areas etc. by elephants and other wild animals rise with serious concern. During 2015-16, 74 people were killed, 64 injured, 4 cattle killed, 1128 houses and 13,112 ha. crop areas were damaged due to elephant attacks mostly in forests and forest adjacent villages/towns of the state. Even 18 people died, 177 injured and 35 cattle died due to other wild animal attacks during the year. The number of human deaths and injuries and house and crop area damage due to elephant attacks are increasing over last few years. State Government had paid compensation amount of ₹14.2 lakh to the victims of elephants and other wild animal's attacks and damages of houses and crop areas of the state during 2015-16. In order to minimize this conflict and to protect the life and property of human beings, the steps taken are :

(a) Day and night patrolling is being carried out in forest and wildlife area. Steps have also been initiated for constituting a 63 member "special tiger protection force" for Similipal forests.

(b) For the conservation of marine turtles and other marine fauna in coastal districts, 5 offshore and 52 onshore camps have also been established during 2015-16.

(c) 3,692 hectares mangrove plantations have been raised during 2000-01 to 2013-14 under central plan scheme. During 2015-16, 75 ha of mangrove plantations have been taken up.

(d) An Elephant Corridor Development Management Plan in 14 elephant corridors has been implemented to reduce man-elephant conflict.

(e) Creation of 191 waterbodies and renovation of 270 numbers to prevent death of wild animals due to water scarcity.

(f) Trench facing over 31 RKM and solar facing over 79 RKM have been created to prevent wild animals entering human habitations.

(g) Provisions of 158 forfeiting squads and modern forfeiting tools have been made in order to prevent fire incidences.

Environment and Pollution Control

Policy Initiatives : Protecting environment and maintaining ecological stability are the most challenging issues facing almost all regions of the world. Major policy initiatives and actions undertaken by the state in this regard are summarised below.

State Pollution Control Board (SPCB) : The SPCB functions under the administrative control of the State Forest and Environment Department and ensures the implementation of the Environmental Acts, particularly the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981 and the Environment (Protection) Act, 1986. In addition, the Board implements the Hazardous Waste (Management, Handling and Trans Boundary Movement) Rules, 2008; the Manufacture, Storage and Import of

Hazardous Chemical Rules, 1989; the Bio-medical Waste (Management and Handling) Rules 1988, the Batteries (Management and Handling) Rules, 2001 and the Plastic Waste (Management and Handling) Rules 2011, the e-Waste (Management and Handling) Rule 2011, other pollution controlling rules and regulations. The achievements of SPCB during 2015-16 are given below.

(a) Granted consent with stipulation of appropriate pollution control measures to 893 industries, hotels and brick kilns etc. and also provided consent to operate to 22,856 industries, mines, hotels, mineral processing units etc.

(b) Issued 314 show cause notices, 324 refusals and 197 closure directions to defaulting units.

(c) Public hearings have been conducted for 14 major industrial/mining/development projects which require environmental clearance from Government of India.

(d) Waste water samples from 3378 industries, samples from 1365 stack emissions, 2556 ambient air samples and 75 solid waste samples from different industrial premises have been collected and analysed.

(e) 237 hazardous waste generating units have been granted authorization under the hazardous waste Rule 2008, for collection, storage, treatment and disposal of hazardous wastes.

(f) The Board has granted authorization to 556 health care establishments under provision of the Bio-medical (Management and handling) Rule, 1998 and also issued show cause notices to 86 units for inadequate managment of Bio-medical wastes.

(g) Under the Municipal solid waste (M & H) Rule 2000, authorization granted to 32 number of ULBs, eleven number (11) of notices have been issued to the ULBs for the noncompliance of the above rule.

(h) 194 cases were filed/counter filed, 52 cases have been disposed.

(i) Awareness programme conducted by the Board on World Environment Day, International, Coastal Clean-up Day and National Pollution Prevention Day to create awareness on environmental protection among public.

The Odisha State Coastal Zone Management Authority

Ministry of Environment and Forests, Government of India have constituted Odisha Coastal Zone Management Authority (OCZMA) under the provision of Environment Protection Act, 1986 for protecting and improving the quality of coastal environment and preventing, abating and controlling environment pollution on the coastal areas. The district level coastal zone monitoring committee for all coastal districts have been constituted in order to enforce and monitor the coastal activities as envisaged in CRZ notification.

Centre for Environmental Studies (CES)

This is a registered society, whose aim is to promote environmental awareness in the state. The institute functions as regional resource agency for the National Environment Awareness Campaign (NEAC) and a nodal agency for the National Green Crops Programme.

During 2015-16, CES organised the World Environmental Day and also eco-model exhibition. CES is also the State Nodal Agent for National Green Cards (NGC) programme of Government of India.

Chilika Development Authority (CDA)

Chilika is one of the important spot of biodiversity. It shelters a number of endangered species and migratory birds. The highly productive eco-system with its rich fishery resources sustains the livelihood of more than 0.2 million fisher folk living in and around the lagoon. Some of the important ongoing restoration activities taken up during 2015-16 include-

(i) Water exchange and salinity gradient of de-saltation in Chilika Lake.

(ii) Bio-diversity conservation and wise use of natural resources.

(iii) Fishery resource development.

(iv) Strengthening of wetland research and trainning centre.

(v) Management of Ansupa lake etc.

Climate Change Action Plan

Odisha was one of the first states that formulated Climate Change Action Plan, through a comprehensive consultative process way back in 2010. The State Government is implementing Climate Change Action Plan to combat the challenges due to climate change. Forest and Environment Department is the Nodal Department for coordinating the implementation of various activities envisaged under State Climate Change Action Plan. A Climate Change Cell has been constituted for interacting with other departments, stakeholde and external agencies for implementation of the key and prioritized activities and take sto of the progress made in implementation of State Action Plan on Climate Change.

Awards

The State Government have awarded 238 Prakruti Mitra in 2015-16 during the ec model exhibition on World Environment Day 2015, in order to encourage environment protection, in which 64 eco clubs of the state participated. State Forestry Awards ar conferred, on the occasion of "World Forestry Day" every year, for outstanding work i afforestation and plantation activities to Grampanchayats, educational institutes and individu students. Besides, these awards are also given to forest staff every year for their meritoriou work in the field of forest protection, afforestation, kendu leaf operation etc. "Biju Pattnai award for wildlife conservation" is being given for outstanding contribution in the field o wildlife conservation.

●

17

ECOLOGICAL REGIONS

- **Ecology and Ecosystem**
- **The Eastern Ghat Zone**
- **The Coastal Zone**
- **The Northern Plateau**
- **The Central Table Land**

Man, plant and animals are included in Biological environment. It is controlled by the science of ecology. **Ecology concerns itself with the interrelationship of the living organisms, plants or animals and their environment.** In the natural environment there is perfect balance or equilibrium between various organisms in the **biosphere.** The ecological balance may be disturbed by changes in the physical environment or changes in the relative numbers of organisms in biosphere. The interdependence between physical and biological elements of the environments in a equilibrium stage is known as **Ecosystem.** On the basis of morphological peculiarities, geological, climatic and ecological inter-relationship, Odisha may be broadly divided into Four ecological regions of first order as follows :

1. The Northern Plateau
2. The Easternghat Zone
3. The Central Table Land
4. The Coastal Zone

1. The Northern Plateau : This region is a **polycyclic region**. These mountains are almost flat topped and runs from North to South in the northern portion and NN to SSE in the Southern portion (750-1100 m) above mean sea level. This plateau as stated earlier, is an extension of Chhota Nagpur Plateau, the southern extension of the central hill belt of India. The entire plateau is dotted with small hills here and there including Joda, Badbil and Banspani hills. The southern part forms the **watershed** of Brahmani and Baitarani rivers. The Simulia hills have two peaks one at **Similipal** (1173 m) and other at **Meghasana** (1160 m). The **Mankadancha** (1100 m), **Malaygiri** (1190 m) in Pallahara and Gandhamardan (1002 m) of Keonjhar district form the Baitarani-Brahmani interfluve. Bangirposi-Bisoi-Rairangpur zone provides a good view of the spread. The mountains that separate the Tel river, a tributary of the Mahanadi, from Rusikulya basin have heights varying from 610 m to 1220 m.

This plateau has rich resources of **iron-ores, coal** and **limestone**. In this region one can see **501 varieties of creepers and plants**, **102 varieties trees** and **82 varieties of orchids**. There are **231 varieties of birds** also. Among the inhabitants of jungle area around Similipal, there are **peacock, tiger, wolf,** 4 horned **antelope, deer, panther, Sambar, Cheetal, Elephant, hyna, bear, fox, nilgai** and **leopard** more than hundred in numbers. In this region, there are rich reserve forests and the Botanical name of the semi-evergreen type of vegetation are :

Artecarpus lakoocha, michella champaca, celtis diandra, Bridelia tomentosa, Saraca asoca, Ficus spp, Mangifera indica, Mesus ferrea, Litsea nitida etc. Besides this Monsoon forests also seen in this ecological region. A leafless period occurs in the dry season, most generally in March-April, while the underwoods and the shrubs remain evergreen. *Toona, ciliata, Delbergia, Sisoo, Sterculia* spp. etc. are common deciduous elements together with *shorea robusta* (sal) and pterocarpus marsupium (bijasal). The height is about 40 m and covers nearly 60-90 per cent of high forest. This region is very rich in flora and fauna and maintain ecological equilibrium.

2. Eastern Ghat Zone : This zone is the most mountainous zone. The North-eastern section in the Eastern Ghat zone extend up to Nilagiri of Balasore district through Daspalla of Nayagarh and Kapilas hills of Dhenkanal district. This section in a low height hills having the plains and valleys of either side. This section get loftier up to the peaks of Singaraju (860 m) and Mahendragiri (1575 m) and Delsagiri (1382 m) of Gajapati district. There are steep hill slopes and small valleys in between. But the central section represents hills of Phulbani and part of north-eastern portion of Koraput district. From Baudh the ghat hills are of 600-700 m height and continue up to Phulbani and in the West of Daringbari of Phulbani district the height again increases to about 1200-1260m (most of the hills are of 900-1100 m in height). The South-East section comprises of the Gunpur-Rayagada-Bissam Cuttack-Kasipur-Chandrapur area. This is a plateau of height 300m above mean sea level. This section has given rise to narrow basin between Banshadhara and Nagabali rivers. In between Banshadhara and Nagabali, a hill range up to 1100 m high stands. The two valleys run almost parallel.

The hill tracts of Kalahandi district chiefly comprise the ranges of hills which run from north-east to the south-west of Bhabanipatna and Western side of Nuapada. The principal hill ranges belong to the Easternghats. The range merges with the Rayagada section (intercepted by the valley of Nagavali and Vanshadhara). The Eastern Ghat extend to Nuapara while the other part is an extension of Chhota Nagpur plateau. The main peaks in this range are Tongri danger (1229 m), Kattighara (953 m) and Karlapat (1213 m). The important valleys and plateaus in between these ranges are Nuapara plateau, Sonabeda plateau and

Gauragarh plateau (610-915 m above mean sea level). Udanti and Sunder rivers have their sources from this plateau. The Udanti and Sundar valley, Tel valley and Utei valley are other important valleys in this region. The Eastern Ghats are biologically very much under explored. The lower groups of plants (cryptogams) and several groups of insects, reptiles, birds seen in the Eastern Ghat regions. The higher hills more than 1000 m above sea level with dense forest one can see **deer, panthers, samber, cheetal, wolf, elephant, hyna, bear** and fox etc.

3. Central Table Land Region : Sambalpur and Bargarh including Padampur form an undulating upland varying in elevation from 146 m to 229 m above mean sea level excluding hills and table lands. The general slope in from north to south. There are isolated hills rising from the plains. There are series of low hill ranges in Redhakhol extending towards Mahanadi valley. Deogarh, Barkot, Kuchinda, Laikera up to Pradhan Pat form the hilly and forest clad section, interspersed are the valleys and plains.

Gandhamardan range runs along the southern boundary of Badasambar, separating it from Sonepur. These hills have height of 630 to 950 m and have the highest peak at Nrusinghanath (986 m). Another range branches off to the west of Nrusinghanath in the north-south direction and then north-east direction to meet Jagdalpur of Madhya Pradesh. Here it is broken by Ong river. Another range runs eastward to Tel and then to north-east direction entering into Raipur, Chhattisgarh. Another range is the Jharghanti range run towards Rengali, north of Sambalpur.

Jharghanti has a highest peak with an altitude of 516 m. There are series of broken ranges in the south of Sambalpur running parallel to Mahanadi river attaining height of 476 m at Mundher and 710 m at Budhenpalli. At Dhama, on the bank of Mahanadi, the height is about 450 m.

In the Deogarh tract there are Khajuria range (up to 745 m), Pradhanpat Range (743 m) and Kaidanta range (816 m). There is a vast plateau in between from west-east to the bank of the river Brahmani at Batispara. The Ushakoti Range near Kansur and Reamala extends up to Kuchinda and Jamankira to the east. These have heights from 600 to 720 m and are thickly forest clad. The southern hilly region forms the watershed between Mahanadi and Brahmani river nearing Athmallik and Anugul. The Botanical name of the semi-evergreen type of vegetation are : *Antecarpus lakoocha, Michella champaka, Celtis diandra, Saraca asoca, Ficus spp, Shorea robusta* (sal), *Pterocarpus marsupium* (bijasal) etc. Among inhabitants of jungle area, there are **peacock, wolf, 4-horned antelope, deer, panther, sambar, cheetal, elephant, hyna, bear, fox and tiger in dense forest maintaining an ecological equilibrium.**

4. Coastal Region : The new districts of Balasore, Bhadrak, Jajpur, Kendrapara, Jagatsinghpur, Puri, Khurda, Ganjam and Gajpati touch the Bay of Bengal. These have been formed by the alluvial deposits of rivers like Subarnarekha, Budhabalanga, Brahmani, Mahanadi and her branches and sub-branches, Rusikulya, Banshadhara and Nagavali. The coastal region from the sea extends inland ward for about 100-120 km. It has its saline belt low lying gahir and patland and the gradually rising uplands merging with northern plateau at the north (Mayurbhanj and Keonjhar), Central table land (Dhenkanal in the middle) and Eastern ghat ranges in the south. This coastal zone can be broadly divided into three long and narrow strips from north-east to south-west, the first strip being saline coast line with mangrove (*Rhizophora*) vegetation, the second strip the alluvial plain (the old Mughalbandi areas) and the third strip the hilly strip (Dalijoda area). In the first strip, there is no hill. In the second and third strip, there are small hills. There are three lakes-Ansupa (near Athgarh), Sara (in Puri district) and Chilika (in Khurda district).

Near Dhanmandal and Jenapur small hilly eruptions stand. From Chandikhol to the west there are Dubri and Daitari hills. From Balugaon, Soleri, Valari, Maula Bhanja near Chilika and Khallikote side small hill ranges continue through Berhampur-Digapahandi-Gunupur-Rayagada of Easternghat ranges. These hills in the coastal zone throw out spurs and promotories into Bay of Bengal forming islands and small valleys. This area, in general, is fertile. The third strip in the hilly strip (Dalijoda). This hilly upland strips chains of forest clad hills. The Nilgiri hills of Balasore district, and the hills near Hadgarh, Athgarh, Badamba, Tigiria, Narsingpur, Gania, Nayagarh and Daspalla gradually merge with the Phulbani hills of the Easternghats. These hills are discontinuous and scattered. All these hills are below 600 m in height above mean sea level.

A study of physiographic situations of Odisha would indicate that except an 80-100 km wide strip from Bhograi of Balasore to end of Gajapati district in the south the rest of the state is studded with hills, mountains, plateaus and valleys.

Botanical name of the chief vegetation are : *Artecarpus lakoocha, Michella Champaca, Celtis diandra, Bridelia tomentosa, Saraca asoca, Ficus spp, Shorea robusta* (sal), Pterocarpus marsupium (bijasal) etc.

Orissa is the soul of India presenting wonder in the wild life. **Bhitarkanika** widely acclaimed **for its bio-diversity in flora and fauna**, it **is the second largest compact mangrove ecosystem in India**. It is also sanctuary and National Park. Extending over more than six hundred square kilometres, it is one of the very few evergreen repository of most **luxuriant mangrove vegetation in the world**. More than **sixty varieties of mangrove plants** are found here which provide home to variety of endangered species. The pneumatophores, better known as breathing roots, stand like sentries of the land. There is a Crocodile Breeding farm at Dangmal. The pride possession of this farm is the white crocodile Sankua, a rare species in the world. Over 170 species of resident and migratory bird of different hue enhance the beauty of the wild. Prominent among them are **King Fisher, Open billed storks, Sea Eagles, Sand Piper,** Darters,**Sea Gulls** etc. Another amazing phenomenon of nature here is the visit of **Olive Ridley Sea Turtles to Gahirmatha** in lakhs twice every year between January and March to lay eggs en masse. So also Chilika is home to a rich variety of aquatic fauna. It is also a sanctuary and winter resort for the migratory birds, some coming from as far as Siberia. Geographic ecology, is of comparatively recent development as a distinct science, but its roots extend well back into the past. Since ecology is a young science, it should be emphasised that its concepts and techniques have not become standardised and there is opportunity and stimulus here for many new investigators and research scholars.

THALLPATHY7

16

TRANSPORTATION

- Road from 2006-07 to 2015-16
- National Highway
- Motor Vehicles
- OSRTC
- Raiways
- Water Transport
- Inland Water Transport (IWT)
- Civil Aviation

A well developed network of transport and communication is a basic infrastructural prerequisite for achieving rapid economic development. Adequacy of infrastructure in transport and communication sector is crucial for attracting investment. The ongoing economic reforms, therefore, attach high priority to development of transport and communication infrastructure. The Industrial Policy, 1996 accords special priority to infrastructural development which in turn would facilitate flow of funds for large investments in the industrial sector. Development of transportation infrastructure is also essential for marketing of agricultural products and enabling the farmers to get a fair price.

Roads

In the absence of adequate internal rail linkage, roadways is the major means of transport and communication to many parts of Odisha. As good roads improve the accessibility of the rural people to markets and facilitate better delivery of services, emphasis is being given to provide all-weather road communication to inaccessible areas and upgrade the existing road network. So far only 40% of approximately 50,000 villages in Odisha have all-weather connectivity as compared to the National average of 60%.

During 2006-07, the total road length of the State comprises of-

3596 km-	National Highways
29 km.-	State Express Highway
3, 855 km-	State Highways
3,842 km-	Major District Roads
6,516 km-	Other District .Roads
20,314 km-	P. Samiti Roads
1,39,942 km-	G.P. Roads
7,298 km-	Forest Roads
17,282 km-	Urban Roads
6,277 km-	Irrigation Roads

- 27,284 km- Rural Roads
- 88 km- GRIDCO Roads

During 2015-16, the total road length of the state comprises of :

- 4855.51 kms - National Highways
- 38.38 kms - Express Highways
- 4148.82 kms - State Highways
- 18590.69 kms - Urban Roads
- 36128.34 kms - Rural Roads
- 11999.46 kms - Other District Roads
- 162476.45 kms - Gram Panchayat, PS Roads
- 7574.90 kms - Forest Roads
- 6277.00 kms - Irrigation Roads
- 88.00 kms - GRIDCO Roads

Toal kms - 254845.32

Odisha fares better than the all India average with respect to road density. The road length for 100 sq.km in Odisha was 164 kms in 2015-16.

If we compare 2006-07 figure with the present figure available for 2015-16, we find increasing road density. Within 9 years (from 2006-07 to 2015-16), the progress is given below.

- Extra 1259 kms of National Highways constructed.
- Only 9 km of Express Highways constructed.
- Only 293 km State Highways constructed.
- Extra 14748 kms of Urban Roads constructed.
- Extra 8844 kms of Rural Roads constructed.
- Extra 5483 kms of other District Roads constructed.
- Extra 23,534 kms of GP/PS Roads constructed.
- Only 276 kms of Forest Roads constructed.
- No irrigation road was constructed within 9 years.
- No GRIDCO road was constructed within 9 years.

National Highways

National Highways (NH) constitute only about 2 percent of the road network in Odisha. It is the linking factor for all major and feeder roads of the state. 41 number of NHs traverse through Odisha with a total length of 4855.506 kms of which 3386.800 kms and 1468.706 kms of NH length are under the control of NH wing of Government of Odisha and National Highway Authority of India (NHAI) respectively. The transfer of NH to NHAI is meant for improvement under the Golden Quadrilateral, NHDP Phase-III and Phase IVB and Port Connectivity Programme. Two districts Keonjhar and Ganjam have NH with more than 300 kms length while eight districts Koraput, Mayurbhanj, Sambalpur, Angul, Deogarh, Jajpur, Kalahandi and Kandhamal have 200-300 kms of NH length. Nawarangpur and Kendrapara have NH network of less than 50 kms of length. Details on improvement/ widening of National Highway are given in Table 91

Table - 91

Achievements of Roads/Bridges of National Highways in 2015-16 and under progress in 2016-17

(in kms)

Items	Achievement during 2015-16	Work under progress, 2016-17
Widening of Two lanes	115.29	882.08
Periodical Renewal	159.16	84.64
Widening to Four Lanes	4.80	2.00

Source : C.E.NH

Gopabandhu Grameen Yojana

The rural connectivity programmes under the scheme of Gopabandhu Grameen Yojana was taken up by the Government. In 2009-10 total villages covered for sadak was 7520 km but in 2015-16 it increased to 13,669 km. Within 7 years there was a remarkable progress in adding 6149 km of Grameen Sadak.

Road Transport

Road transport accommodates an overwhelming proportion of passenger and freight traffic among all major modes of transport in Odisha. With remarkable expansion of road length (highways and other roads) over the years, the motor vehicle (MV) population have grown mani fold in Odisha. As on 31st March 2016, the state has 58.41 lakh 'registered' and 54.91 lakh 'on road' vehicles. 5.13 lakh new vehicles were registered in 2015-16. Details are given in Table 92.

Table - 92

Motor Vehicles on Road in Odisha

Vehicles	Number of vehicles on road as on						
	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Goods vehicle (truck to tempo)	159881	169032	188974	268065	235112	249001	270071
Public/Private bus	8908	12264	13565	25432	15755	16621	17770
Motor car/jeep/taxi	164614	189197	228921	315486	310641	349561	389787
Auto rickshaw	55364	55364	66847	80372	82695	97570	113125
Motorcycle/scooter mopeds	2132508	2453347	2784485	3307110	3544754	3928199	4430546
Others (tractor, trailors, treckers and others)	120792	154740	171644	226995	208755	234950	269365
Total	**2639576**	**3033944**	**3454436**	**4223460**	**4397712**	**4875902**	**5490664**

Source : *State Transport Authority, Odisha*

Motor Vehicle Population

Odisha has heterogeneous mix of composition of MVs which is skewed in percentage share. More than 80 percent of the MV population are 2-wheelers followed by car/taxi (percent). The predominance of personalized vehicles like 2-wheelers, cars etc become an area of concern for the state in terms of traffic congestion, management, auto pollution, parking and road accidents problems. Heavy motor vehicles (HMV) such as buses, trucks, tractors are mostly privatized in the state. As on 31st March 2016, 17770 number of buses (372 public buses and 17398 private buses) were plying on roads in Odisha with 42 buses per lakh of population. Goods movements are predominantly managed by 2.70 lakh vehicles in Odisha. So trucks bear enormous importance in the goods movement, delivery and accessibility to producers and consumers.

(i) Policy and Administration of Road Transport : Transport is a concurrent subject. Odisha is the leading state in India to declare State Transport Policy in 2007. The main objectives of this policy are : to increase competition, efficiency, transparency, accessibility and adequate availability of transport services in the state, ensure user friendly road transport and evolve an improved urban transport system. The policy included forming institutional and regulatory mechanisms like the Odisha Transport Infrastructure Development Authority (OTIDA) and Odisha Transport Regulatory and Advisory Council (OTRAC). It also identified special thrust areas to modernize railways, waterways and airways in the state. The State Transport Authority (STA) is the apex regulatory body that manages transport administration, regulation, revenue collection and road safety in the state. The regulatory mechanism of STA includes economic regulation (fare, taxes, revenue etc), physical and infrastructural regulation (vehicle, maintenance, fitness, amenities etc), and social policy regulation (energy, safety, user interest etc.). Odisha has 35 RTOs, 13 border check gates, 1 government driving training school at Bhubaneswar, 1 PPP mode driving training school at Chattia, Jajpur and more than 70 privately run driving training schools functioning under STA. Odisha State Road Transport Corporation (OSRTC) provides public transport bus services and amenities to passengers and road users.

Biju Gaon Gadi Yojana (BGGY)

Government of Odisha launched a rural transport connectively scheme, named as BGGY, in February 2014 to make the mobility of rural people more accessible, comfortable, economical and diversified. BGGY operate in 3 phases, 1^{st}, 2^{nd} and 3^{rd} phase covering 12, 5 and 13 districts respectively. As on 31^{st} March, 2016, 501 buses under BGGY are plying.

Major initiatives on road transport during 2015-16 are elaborated. One HMV driving training school was established at Chattia in Jajpur district on PPP mode. It is proposed to set up 2 driving training schools on PPP mode at Berhampur and Keonjhar. A new bus stand is constructed at Malatipatapur, near Puri at a cost of ₹ 70.70 crore during Nabakalebar at Puri held in 2015. Online application for learner's license, permit issue, tax collection, e-dispatch of driving license and registration certificate and enforcement (Tough book) have been introduced by STA. Two major border check gates Laxmannath and Loharchati have been modernized.

(ii) **Road Accidents and Safety Measures :** Road accident is closely associated with mobility. Faster growth of vehicle population, heterogeneous mix of vehicles, technology development in transport, poor driving skills and deficient road condition and human error etc have led to an imposing dimension and severity of road accidents in the state. During 2015, 10542 road accidents with lives of 4303 were recorded against 9648 road accidents in 2014. The fatality rate due to road accidents in Odisha increased from 40.70 deaths per 100 accidents in 2014 to 40.9 in 2015. STA, Odisha collaborates with Odisha Road Safety Council, Ministry of Road Transport and Highways, Police Department, Voluntary Organizations and State Truck and Bus Owners Associations to implement road safety measures. During 2015-16, the STA implemented the following initiatives to maintain road safety. Govt. of Odisha has formulated "Road Safety" Policy of Odisha - 2015 with the objective of reducing road accidents and fatalities by 20 percent within 2020. A public call centre with toll free telephone number has been established in STA for redressal of grivances and assistance of general public and to act as an accident help line. School bus policy has been formulated for safe transportation of the school children. Accident black spots have been identified by road department and traffic calming technique has been taken up. 37 highway interceptors are deployed for checking drunken driving and rash driving etc. 9 accident helpline centres, 20 ambulances and 15 cranes have been deployed on highways to provide round the clock post-accident trauma care services to accident victims. One traffic safety training park and one First aid Training Centre are established at Chandrasekharpur, Bhubaneswar.

(iii) **Odisha State Road Transport Corporation (OSRTC) :** OSRTC functions to provide safe and dependable transport facilities to the public. During 2015-16, the corporation had 371 buses on road with an average fleet strength of 459 and regular staff strength of 570 with a bust staff ratio of 1:3.48. Vehicle position and income performance of OSRTC during 2015-16 are given in Table 93.

Table 93

Vehicle Position of OSRTC

On-road Vehicles	Off-road Vehicles	No.of Routes	Fleet Utilisation	Average vehicle utlisation
371	95	220	81%	242 km

Source : OSRTC

Table 94

Financial Position of OSRTC

Per km Expenditure	Income	Expenditure	Per km Income	Per km Expd.	No. of Passengers transported	Parking fees collection	Profit/Loss during 2015-16
₹23.17	₹1817.00 lakhs	₹7531.00 lakhs	₹26.71	₹23.17	69.64 lakhs	₹165.21 lakhs	(+)₹2.86 crore

Source : OSRTC

RAILWAYS

Railway routes pass through twenty-three districts of the state, excluding Boudh, Deogarh, Kandhamal, Kendrapara, Malkangiri, Nawarangapur and Nayagarh. The density of coverage is relatively high in some regions of the state, while central parts remain largely untouched. A large disparity across districts exists. By the end of 2015-16, the state had 2606.267 km of railway lines. Overall, railway coverage is poor in the state and this is one of the factors that has hampered the pace of its industrial development. The railway route length in the state per thousand sq km, which is the same as railway density, is about 16 km, while the national railway density is around 20 km. During 2015-16 the following progress of railways in Odisha have been made :

(i) Government of Odisha made committed contribution of equity of 26 percent for 2 SPV mode railway projects. ₹ 105.70 crore and ₹ 127.80 crore were contributed by State Government for Haridaspur-Paradeep and Angul-Sukinda rail projects respectively from 2013-14 to 2015-16. The project operation are stepped up by this contribution.

(ii) State Government provided free of cost land and 50 percent of construction cost for stretch of 112-289 kms (Daspalla-Balangir) segment of total Khurda road-Balangir Railway project after Ministry of Railway sanctioned for 0-112 km stretch (Khurda road-Daspalla) segment only of the same route due to low economic return factor. An amount of ₹ 12 crore was provided for land acquisition and ₹ 38 crore for construction as state share during 2015-16.

(iii) Odisha will provide ₹ 60 crore for modernization of Bhubaneswar Railway Station.

(iv) Land acquisition have been completed for 329 villages out of total 333 villages for 4 ongoing railway projects namely Haridaspur-Paradeep, Khurda road-Balangir, Angul-Sukinda and Talcher-Bimalagarh rail links.

(v) A budget allocation of ₹ 4682 crore during 2016-17 has been made in favour of state in Railway Budget enhancing 30 percent from last year with sanction of following 5 nos. of important new railway lines such as Jeypore – Nawarangpur, Jeypore - Malkanagiri, Sambalpur – Berhampur, Badbil – Banspani and Junagarh – Nawarangpur – Ambaguda rail lines.

WATER TRANSPORT

(i) Paradeep Port : Paradeep Port, declared as the 8th major port of India in April, 1966 by Government of India, is the only major port in Odisha and the first major port on the East Coast commissioned in independent India. The port is situated 210 nautical miles south of Kolkata and 260 nautical miles north of VIsakhapatnam. It has an artificial type lagoon of 500 meters length, 160 meters width and one turning circle of 520 meters diameter. The port is equipped with 15 berths, three single point moorings and one Ro-Ro jetty for handling various cargoes. Of this, 8 berths are fully mechanized for handling of iron ore, thermal coal and POL. Two berths are captive berths in which fertilizers are handled.

one berths has been allotted to M/s. ESSAR for handling of iron ore pellets on captive basis and the others are multi-purpose in nature and semi mechanized. The port has 126.94 million tons of cargo handling capacity as on 31st March, 2016. The major ongoing capacity addition projects in the port are southern oil jetty, multipurpose clean cargo berth, deep drought coal berth and deep drought iron ore berth on BOT basis. During 2015-16, 76.39 million tons of cargo (47.90 million tons of import and 28.49 million tons of export) was handled through this port with an average of 4.75 hours pre-berthing detention, 2.15 days turn-around time and 21139 MT ship berth-day output. POL and thermal coal together constituted 78.00 percent of the total cargo handled through this port during 2015-16. Details of the year wise Cargo handled by Paradeep Port have been shown in Table 95.

Table - 95

Cargo handled at Paradeep Port

(in million tonnes)

Year	Import	Export	Total	Growth (%)
2004-05	8.44	21.66	30.10	18.92
2005-06	11.42	21.69	33.11	10
2006-07	13.66	24.86	38.52	16.34
2007-08	16.85	25.59	42.44	10.18
2008-09	19.89	26.52	46.41	9.35
2009-10	29.18	27.83	57.01	22.84
2010-11	31.22	24.81	56.03	(-)1.72
2011-12	35.99	18.26	54.25	(-)3.18
2012-13	39.11	17.44	56.55	4.24
2013-14	40.67	27.33	68.00	20.25
2014-15	46.19	24.75	71.01	4.43
2015-16	47.90	28.49	76.39	7.57

***Source** : Paradeep Port Trust*

Major achievements of Paradeep Port Trust (PPT) during 2015-16 are given below:

PPT handled 76.39 million tons of cargo, the 2nd biggest position of cargo traffic among major states for last 3 years, 3 projects were awarded namely supply, installation, commissioning operation and maintenance of RFID system at Paradeep Port. Signing of concession agreement with JSW Paradeep Terminal Pvt. Limited (JSWPTPL) of new Deep Draught Iron Ore Berth and New Multipurpose Clean Cargo berth. 100 percent utilization of installed capacity of 21 MTPA of mechanized coal handling plant and handled 23.63 MMTPA during 2015-16.

Amongst the major ports, PPT is predominantly using rail and pipeline mode for cargo conveyance and thereby reducing the road traffic. For the first time 11,473 tons of

Alkylatae and 18,937 tons of Naphtha (POL Product) were handled during the month of January, 2016 and 18,937 tons of Naphtha (POL Product) was exported during the same period.

(ii) Other Ports : With 480 kms of coast lines, Odisha has 13 potential sites for minor ports development. These minor ports are located at Gopalpur, Behuda Muhan and Palur in Ganjam district; Baliharchandi and Astaranga in Puri district; Jatadhar Muhan in Jagatsinghpur district; Inchri, Chandipur, Bahabalpur, Kirtania and Bichitrapur (Talasari) in Balasore district and Dhamra and Chudamani in Bhadrak district. Dhamra port is commercially operational while Gopalpur and Kirtania minor ports are under development with private sector support. Government of Odisha makes efforts to develop a riverine port on Mahanadi River near Paradeep to boost coastal shipping. Odisha has declared Port Policy in 2004, Odisha Boat Rules 2004 and Maritime Board Bill, 2012 for proper development, management, registration, operation and monitoring of prots and boats with private participation.

(iii) Inland Water Transport (IWT) : IWT has vast potential but less network in Odisha. The passenger launch services are used in remote areas where other modes of transport are generally lacking. Inland water transport services are provided by the State Government. The Directorate of Port and Inland Water Transport is under the administrative control of Commerce and Transport Department. Government of Odisha is the nodal agency, which controls activities relating to passenger launch services, survey and registration of inland crafts. Passenger motor launch services are operative in five different water routes in two sectors, i.e., Chandbali and Balugaon sectors. Chandbali sector provides launch service from Chandbali to Talachuan, Chandbali to Aradi and Bhitarkanika (on reservation) through 4 numbers of motor launches. Balugaon sector provides services from Balugaon to Krushnaprasad Gada and Kalijai through 3 motor launches and also services from Nuagada to Ganda Kulai via - Kaliakana with the help of one motor launch. During 2015-16, 1.64 lakh passengers moved by IWT and ₹25.28 lakh revenue were collected from fare.

Table - 96

Passenger Traffic and Revenue Collected from Inland Water Transport Services

Year	No. of Passengers (in lakh)	Fare Collected (in ₹ Lakh)
2005-06	1.33	19.52
2006-07	1.15	17.21
2007-08	1.08	18.75
2008-09	1.04	19.19
2009-10	1.22	23.08
2010-11	1.42	24.96
2011-12	1.26	21.22
2012-13	1.25	20.29
2013-14	1.25	21.62
2014-15	1.42	20.26
2015-16	1.64	25.28

Source : *Directorate of Inland Water Transport, Odisha*

Table 96 provides data on passengers and revenues raised from 2005-06 to 2015-16. Government of Odisha has formulated Odisha Boat Rules, 2004. As per these rules all types of boats are to be surveyed and registered before plying in inland waters of the state. During the financial year 2015-16 an amount of ₹4,51,400/- has been collected from 350 boats towards survey, registration and renewal charges. The Executive Engineer, Ports and IWT. Mechanical Division, Cuttack under the Director, Ports and Inland Water Transport conducts examination for granting certificates of competency to Serangs, Masters, Engine Drivers and Inland Engineers. During 2015, 245 candidates appeared for certificate examination and 203 of them passed. Crew Training Institute, Chandabali in the district of Bhadrak also functions under the Directorate of Ports and Inland Water Transport. At present the institute conducts two types of courses :

(i) 10 Month Regular Course for general candidates, and

(ii) 3 month Refreshing Course for in-service candidates in Engine and Deck Rating.

The trainees of this institute get their jobs inside and outside the state.

CIVIL AVIATION

The Directorate of Civil Aviation is to look after the use and maintenance of the State Government's passenger aircraft and trainer aircrafts, training of student pilots and construction and development of air strips in the state. There are 19 airstrips across 15 districts of which 12 are owned by Government of Odisha. There are sixteen helipads in Odisha. Biju Pattanaik Airport at Bhubaneswar has been declared as International airport. A proposal for procurement of new aircraft is under consideration. A Government Aviation Training Institute, set up under a public Private-partnership mode, has started functioning since November, 2008. An amount of ₹30 crore has been proposed during 2015-16 for construction and development of existing airstrips and their infrastructure along with construction of new airstrip at Malkangiri.

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15

SCIENCE AND TECHNOLOGY

- **Objectives of Science and Technology**
- **Info Valley Project**
- **Setting up new STPI in Odisha**
- **Bhubaneswar city WIFI**
- **Ne GP**
- **NOFN**
- **IIIT**
- **OBA**
- **Pathani Samanta Planetarium**
- **Institute of Mathematics and Application**
- **NIC**
- **SCST**
- **Biotechnology**
- **OSWAN**
- **UID Project**
- **OSAC**

Science and Technology play a vital role in the process of development and transformation of a traditional agrarian economy into a modern industrial economy. Development of science and technology in the State has the following primary objectives.

(i) To keep abreast of the latest developments in the field of science and technology and to take necessary steps for dissemination of these among institutions like Industries, research laboratories, universities and among scientists and technologists.

(ii) To co-ordinate R and D Programmes of different departments, industrial and research institutions and to ensure scientific and technical co-operation among these institutions and agencies.

(iii) To formulate, finance research and application programmes in the field of science and technology.

(iv) To encourage, develop and extend the use of renewable sources of energy including energy plantations.

(v) To popularise Remote Sensing Technology and make effective use of it.

(vi) To popularise science and technology among the people in general and students in particular, so as to inculcate them a scientific temper and attitude.

Now the following are the important activities (Road Map) of the Electronics and Information Technology Department to be executed through OCAC its "Technical Directorate", IDCO Bhubaneswar and STPI Bhubaneswar during the financial year 2015-16.

1. Digital India Programme : The Digital India Programme is a priority initiative of the government of India with a vision to "transform India into a digitally empowered society and knowledge economy". The three key vision areas of the Digital India Programme include "Infrastructure as a utility to every citizen", "Governance and Services on Demand" and "Digital Empowerment of Citizen."

2. Info Valley Project (Info city-II) : Info valley project (Info city-II) is under construction at Goudakashipur, Bhubaneswar. IDCO, Bhubaneswar has been assigned to implement the project by way of infrastructure development like construction of road and compound wall, water supply and electricity. The total land area earmarked for the project is 625 acres (262 acres SEZ, 215-EMC, 113-Green area and 35 Business Park).

In the meantime, 50.919 acres of land in Info valley SEZ area have already been allotted in favour of M/s. Infosys Ltd. which is the anchor tenant. Infosys has a plan of 15000 IT Manpower to be deployed at this centre in next 3 years time.

3. Setting up of new STPI in Odisha : At present there are four Software Technology Parks (STPIs) in Odisha at Bhubaneswar, Rourkela, Berhampur and Balasore. From Govt. of India, proposal has been received for setting up of 6 more STPIs in the state at Jajpur, Sambalpur, Koraput (Jeypore), Angul, Rayagada and Kalahandi (Bhawanipatna) and feasibility report for the three STPIs at Angul, Sambalpur and Jajpur has already been sent to Govt. of India for final approval.

4. Bhubaneswar City WiFi : Govt. of Odisha has envisaged in creating Wi-Fi hot spots across Bhubaneswar to make the city completely Wi-Fi enable. The STPI Bhubaneswar has been entrusted with the work and the DPR is being prepared for tender. The PoC is going on very effectively at six locations like Saheednagar, Airport, Vanivihar, Surya Nagar, OUAT area and Forest Park area.

5. National e-Governance Plan (NeGP) Projects : The 4 components of NeGP have also included in Digital India Programme through e-Kranti are Odisha State Wide Area Network (OSWAN); Odisha State Data Centre (OSDC); The State Service Delivery Gateway (SSDG) and The Common Service Centre (CSC).

6. Odisha State Wide Area Networks (OSWAN) : The State Wide Area Network envisages creating a core network for the entire State of Odisha covering the State Head-quarter, District Head quarters, Sub-Divisional Headquarters and Blocks.

This network is connected from the State Headquarter (SHQ) to District Headquarters (DHQ) down to Block Headquarters (BHQ). M/s TCIL has been engaged as the consultant for the project.

7. Student Academic Management System (SAMS) : OCAC has implemented this project as an extension of e-college project for Higher Education Department to introduce e-Admission and e-Administration. The project has covered all the 671 degree colleges and 1334 junior colleges of the state. It is running successfully for the last five academic sessions.

8. National Optical Fibre Network (NOFN)/Bharat Net Project : As per the Government of India mandate all the Gram Panchayats of the state will be connected through optical fibre connectivity under NOFN project. This will also be extended to villages in the second phase. Bharat Broadband Nigam Limited (BBNL), a SPV of BSNL, PGCIL, RAILTEL, is the nodal agency for implementing this project and for Odisha PGCIL is the agency to implement. The execution of National Optical Fibre Network (NOFN) is taken by the Govt. of Odisha with an MOU with Bharat Broadband Nigam Limited (BBNL) more than two years for connecting the 6235 GPs in the state. The State Govt. granted the Right Of Way (ROW) to BBNL along with instructions to all Collectors to provide necessary support to BBNL for connecting all GPs.

9. UID Project : The Aadhaar project in Odisha started in the year 2010. The State Government took proactive step for implementation of UID enrolment in Odisha. The UID enrolment programme is extended upto 31st March, 2018 by the Government of India.

10. Institutions with State Government Initiatives

(a) International Institute of Information Technology (IIIT), Bhubaneswar : IIIT, established by Government of Odisha at Bhubaneswar and notified as a Unitary University, aims to meet quality faculty requirement in the IT disciplines of Engineering Colleges and cater the need of IT and ITES industries. It mandates to nurture academic research in cutting edge technologies and industry sponsored research programmes. A sum of rupees 10 crore has been provisioned during 2015-16 for construction of infrastructures like hostel, studio apartment, faculty housing and guest house etc.

(b) Odisha Space Application Centre (OSAC) : OSAC is an apex organization promoting remote sensing technology in the state. Remote sensing data are used in agriculture, transport, land use, revenue, urban development, drinking water, flood mapping, wetland and wasteland development, block level resource mapping, forest and environment sectors. OSAC has undertaken several projects for the Central and State Governments. Important activities of OSAC during 2015-16 are depicted below.

Block level resource atlas and GIS data base generation has been developed under "Odisha Sampad" land used map updation of Phulbani, Kendrapara, Biridi, Balikuda, Angul, Rajgangpur, Biramitrapur and Anandapur (town) have been completed. Classroom teaching transmission in English, Mathematics, Science and Geography has been made for Class IX and X under EDUSAT programme. Five GPS survey for 13 mining lease areas, 10 mineral blocks and 1 coal block area has been completed. Authentication of map showning forest area proposed for diversion for 84 proposals have been completed. Geo referencing of forest block of 50 forest division has been completed. Khariff rice acres and production forest for Odisha has been released in collaboration with MAHANALOBIS NATIONAL CROP FORECASE CENTRE. Wave base power atlas of Cuttack circle has been completed and this project has been developed for entire state. Land bank clusters have been identified and mapped for 2.4 lakhs acres in 22 districts. Inter draft Geospatial server has been installed in OCAC. A pilot project on Subagi Minor Irrigation Project in Narasinghpur block of Cuttack district on development of GIS based canal network monitoring system has been completed. Geospatial technology project has been implemented in 3 blocks of Cuttack district. OSAC guided the district level irrigation committee (DLIC) for preparation district irrigation plan for 6 districts i.e. Angul, Dhenkanal, Kandhamal, Keonjhar, Khorda and Mayurbhanj to implement Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) shifting cultivation map of Koraput and Rayagada district has been prepared. DGPS survey of Samukabeach project near Mangala Nala of Puri district have been carried out. Geo conference map of Bapuji Nagar area has been prepared. GIS based plan for optical fibre routing connecting districts, blocks, GPS has been generated.

(c) Institutue of Material Sciences (IMS) : The IMS provides research facilities in material science and conducting inter-disciplinary research on special materials in order to exploit huge untapped natural resources materials available in Odisha and upgrade to value added products. During 2015-16, three research scholars of IMS have awarded their Ph.D and out of them one from Ravenshaw University and two from Utkal University.

11. Odisha Bigyan Academy (OBA) : OBA aims to popularize science and technology in the state. Monthly science magazines in Odia 'Bigyan Diganta' and 'Science Horizon' in English were published during 2015-16. OBA organized a series of science events such as its Foundation Day, National Science Day - 2016 and World's Student's Day observations, presenting many science awards on Scientific Literature in Odia and popular science lectures.

12. Pathani Samanta Planetarium : Pathani Samanta Planetarium aims at creating awareness on astronomy, astrophysics and space science among people and young students in particular. Since its inception in 1990, the planetarium has increased its activities many fold. During 2015-16 (end of Feb 2016), 1421 numbers of PSP shows were conducted in this planetarium and about 1.58 lakh persons including 0.61 lakh children visited teh shows (Table-90).

Table - 90

Visitors and Revenue Collected at Pathani Samanta Planetarium

Year	No. of Visitors	Revenue collections (in ₹)
2004-05	92903	854652
2005-06	93522	848580
2006-07	133289	1219350
2007-08	112056	1336369
2008-09	90019	1097609
2009-10	88341	1116183
2010-11	47934	581657

Year	No. of Visitors	Revenue collections (in ₹)
2011-12	27166	3298851
2012-13	151508	2688914
2013-14	155516	2796520
2014-15	134724	2548290
2015-16	157855	3041110

Source : Pathani Samant Planetarium

13. Institute of Mathematics and Application (IM&A) : IMA aims at pushing research on mathematics, advance applications and nurture talents on mathematics. It conducts research activities in 7 advanced areas of mathematics. Regular workshops, seminars, training programmes for teachers and students, both for rural and urban areas are conducted.

14. National Informatics Centre (NIC) : National Informatics Centre (NIC) is a core of Science and Technology Organization under the Department of IT of Government of India, and is actively working for the last three decades in the areas of Information and Communication Technology (ICT) applications in public sector. NIC, Odisha State Centre, has been playing the principal role in promoting IT culture for effective governance at the state and district levels. Both the State Government and NIC have taken several initiatives in this regard. The major achievements of NIC, Odisha Centre include the following schemes during 2015-16.

(i) **Aadhaar Enabled Jeevan Pramaan Certificate** (Digital Life Certificate) for State Govt. Pensioners.

(ii) **Dynamic Portal of Odisha Crime Branch :** This portal covers Tracking the Missing persons, Cyber crime, Women trafficking, Economic Offence Wing, Special task force, Citizen charter etc.

(iii) **ASSA (Automation of Small Savinngs Activitites) :** This portal has been developed to capture data on small saving deposits at field level offices across the state.

(iv) **Online portal for registration of Odisha Building and other Construction Workers' Welfare Board :** It provides a system to get online help and cess collection bebefits to labourers.

(v) **Online Cataloguing System of Odisha State Archives :** It includes archive of books, records, newspaper, publication, voice recordings of freedom fighters, maps, microfilms etc.

(vi) **Pathsala :** The web based application is an integrated module for faculty registration, student and teacher attendance, classes taken status, time table management, online internal assessment etc.

(vii) The web based applications like State Seed Testing Laboratories have been integrated with the workflow automation system of Odisha state seed and organic products certification agency. Fertiliser Monitoring System, Workflow automation system of Odisha Agro Industry Corporation, Odisha seeds portal etc. have been developed in agriculture sector.

(viii) **RIDF (Rural Infrastructure Development Fund) :** This portal has been developed to capture projects details taken under RIDF scheme to monitor the physical and financial achievements of the projects.

15. State Council on Science and Technology (SCST) : The SCST is the apex policy-making body for development of science and technology and overseeing the implementation of various programmes. It extends financial support for application-oriented research projects, publicity, seminars, workshops and conferences. Action has been taken for setting up Sub-Regional Science Centre at Tukurla Bhati Tahasil in Bargarh district, Umri near Jeypore in Koraput district, Bodapalasa in Keonjhar district, Khandapada in Nayagarh district and Gopalpur in Ganjam district.

16. Biotechnology : Biotechnology emerged as a leading component of science and technology that has direct bearing on food security, nutritional supplementation, health care production and industrial applications etc. Odisha made impressive progress on biotechnology during 2014-15. Research grant has been sanctioned for 13 ongoing biotechnology research and development projects. 32 scholarships have been provided to PG students of different universities and colleges for biotechnology studies. The state has been developing a State of the Art Biotech Pharma IT Park over an area of 64.613 acre in Bhubaneswar in PPP mode. Guidline for awards of Emeritus Fellowship in Biotechnology and for awards of Biju Pattanaik Research Fellowship in science (Biotechnology) has been prepared.

The Government of Odisha has been proactive in corporating IT its own administration as well as helping the growth of IT is general. Electronics and Information Technology Dept. of the state has the mandate for development, co-ordination, supervision of IT activities including computer, communication, software and electronics in the state. OCAC, OSEDC, IIT, STPI and IDCO are institutions that help in promotion of IT and e-governance projects in different sectors of Government of Odisha.

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THALLPATHY7

13

POWER

- ☞ Power supply-demand scenario
- ☞ Power Generation (availability)
- ☞ Estimated demand for power
- ☞ Power Consumption
- ☞ Rural Electrification
- ☞ Rajib Gandhi Grameen Vidyutikaran Yojana
- ☞ Biju Saharanchal Vidyutikaran Yojana
- ☞ CAPEX
- ☞ Energy Conservation
- ☞ DISCOMS
- ☞ OPGC
- ☞ Institutions GRIDCO Ltd.
- ☞ OHPC
- ☞ OPTCL
- ☞ Odisha Renewable Energy Development Agency

POWER

Energy is the driving force of state economic growth, either in the form of finite resources such as coal, oil and gas or in renewable forms such as hydroelectric, wind, solar and biomass or its converted form of electricity. The energy sector not only profoundly influences the diversified economic activities but also bears direct bearings on the quality of the state's air, water, land, forest resources and climate changes. The power sub-sector along with gas and water supply sub-sector contribute about 2.5 percent of the Odisha's GSDP in real terms at 2011-12 base. The growth of this sub-sector has however, widely fluctuated from year to year due to several factors including availability of inputs such as coal, gas or oil, environmental constraints and natural shocks. Significantly, 12th plan has proposed ₹ 13,485.25 crore outlay for energy sector in Odisha as against ₹ 2,649.94 crore plan expenditure for same sector in 11th plan.

Power Supply-Demand Scenario

(A) Installed Capacity : The total installed capacity of all power projects (Odisha's share) in the state increased to 5593.61 MW in 2015-16 as against 5531.58 MW in 2014-15, with an increase by 1.12 percent, as shown in Table 81.

Table - 81

Demand and Availability of Power

(in MW)

Year	Demand (Estimated)	Availability of Power from different sources						
		State Sector	Central Sector	Other Sources	Purchase from Captive Plants of the State	Total	Installed Capacity*	Sold to other States
2004-05	1578	1459	498	–	69	2026	4845.34	517
2005-06	1649	1275	525	–	62	1862	5073.48	250
2006-07	1760	1543	485	–	92	2120	5178.89	207
2007-08	1997	1563	736	–	82	2381	6067.90	311
2008-09	2107	1375	763	–	130	2268	6745.75	32
2009-10	2240	1157	773	–	485	2415	7990.25	50
2010-11	2398	1295	814	–	729	2838	9456.60	128
2011-12	2674	1136	1170	68	225	2599	10114.00	49
2012-13	2674	1226	1221	89	239	2776	8859.00	136
2013-14	2746	1521	1223	67	89	2900	5054.00	213
2014-15	2910	1552	1310	33	124	3019	5532.00	137
2015-16	2934	1466	1275	85	75	2901	5593.61	44

Source : *GRIDCO*

** Includes installed capacity of the state's share in central sector projects and captive power plant capacities.*

The power projects include state sector, central sector, other power sources and Captive Power Plants (CPP) of some industries in the state. Power is generated by hydro power, thermal power and renewable energy sources like solar and bio-mass plants in Odisha. As on 2015-16, the state had 10 hydro power and 9 thermal power projects (both State and Central sectors); 01 bio-mass project; 02 small hydroelectric projects; 14 SPV projects and 33 number of CPP in major industries to supply the power to the state. Power is also supplied to Odisha through other trading companies' sources like ER UI Pool, PTC, APPCPL, NVVNL IEX etc. The hydro power, thermal power (State and Central Sector) and other power sources (renewable, independent and CPP) share 41, 37 and 22 percent respectively of total installed capacity of the power projects in Odisha.

(B) Power Generation (availability) : During 2015-16, 2901 MW was available for power consumption from all sources that stood 51.86 percent of total installed capacity of power projects in the state. The state sector, central sector and other sources (including CPP) contributed 53, 42 and 5 percent respectively of total power generation in Odisha during 2015-16. Among the 33 CPP that supplied 74.895 MW to GRIDCO in 2015-16, Bhusan Power and Steel Ltd, Jharsuguda (17.08 MW), JSPL, Meramundali (16.86 MW), JSL, Duburi (8.238 MW), Bhusan, Stainless Ltd, Meramunduli (6.4 MW) are the leading Captive Power Plants (CPPs). Global climate change necessitates developing alternative renewable energy sources like Biomass, Solar power, etc. to ease out the pressure of climate change prone thermal and hydro power generation.

(C) Estimated Demand for Power : The demand for power in Odisha in 2015-16 is estimated at 2934 MW as against 2910 MW in 2014-15. The State's estimated power demand increased many fold in last 10 years between 2005-06 (with 1649 MW) and 2015-16 (with 2934 MW) as depicted in Table 81.

Power consumption is a flow concept while demand for power is a stock concept. The total power consumption of Odisha was 15923 MU in 2015-16 as against 15440 MU in 2014-15. Industrial and domestic consumption together share about 75.44 percent of total power concusmption of the state. However, domestic consumption (37.95 percent) exhibits an unswing trend while industrial consumption (37.49 percent) suffers from stagnancy or downswing over last few years. The down swing is due to the impact of global slowdown since 2008-09. The power consumption status of Odisha is depicted in Table 82.

Table - 82
Power Consumption in Odisha

(Consumption in MU)

Year	Total consu-mption	Consumption Sector							
		Domestic	Commercial	Industrial	Public lighting	Irrigation and agriculture	Railways	Public water works	Bulk supply and others
2004-05	7598	2352	482	3742	41	147	355	126	353
		(30.96)	(6.34)	(49.25)	(0.54)	(1.93)	(4.67)	(1.66)	(4.65)
2005-06	8144	2483	558	3941	55	137	384	129	457
		(30.49)	(6.85)	(48.39)	(0.68)	(1.68)	(4.72)	(1.58)	(5.61)
2006-07	9288	2525	640	4967	45	131	525	134	321
		(27.19)	(6.89)	(53.48)	(0.48)	(1.41)	(5.65)	(1.44)	(3.46)
2007-08	10761	2679	891	6090	51	132	594	142	182
		(24.90)	(8.28)	(56.59)	(0.47)	(1.23)	(5.52)	(1.32)	(1.69)
2008-09	11747	2914	1087	6548	54	155	627	151	211
		(24.81)	(9.25)	(55.74)	(0.46)	(1.32)	(5.34)	(1.28)	(1.80)
2009-10	12228	3190	944	6542	56	154	735	172	435
		(26.09)	(7.72)	(53.50)	(0.46)	(1.26)	(6.01)	(1.40)	(3.56)
2010-11	13099	3533	1113	6755	58	179	797	189	475
		(26.97)	(8.50)	(51.57)	(0.44)	(1.37)	(6.08)	(1.44)	(3.63)

Year	Total consumption	Consumption Sector							
		Domestic	Commercial	Industrial	Public lighting	Irrigation and agriculture	Railways	Public water works	Bulk supply and others
2011-12	13054	3946 (30.23)	1349 (10.33)	6246 (47.85)	61 (0.47)	151 (1.16)	891 (6.82)	200 (1.53)	210 (1.61)
2012-13	13552	4261 (31.44)	1513 (11.16)	6147 (45.36)	65 (0.48)	162 (1.20)	930 (6.86)	213 (1.57)	261 (1.93)
2013-14	14213	4585 (32.26)	1559 (10.97)	6291 (44.26)	72 (0.51)	186 (1.31)	1015 (7.14)	222 (1.56)	283 (1.99)
2014-15	15440	5473 (35.45)	1703 (11.03)	6344 (41.09)	81 (0.52)	229 (1.48)	1031 (6.68)	236 (1.53)	343 (2.22)
2015-16	15923	6042 (37.95)	1845 (11.59)	5970 (37.49)	88 (10.55)	261 (1.64)	1088 (6.83)	247 (1.55)	382 (2.40)

Sources : *CESU, NESCO, SOUTHCO and WESCO*

Note : Figure in bracket indicates percentage to total consumption

Rural Electrification

Electricity is basic requirement of life today. Like other states, Odisha has also been making efforts for village electrification. Out of 47,675 villages in Odisha, 92.88 percent villages have been electrified by the end of 31st March, 2016 as against all India figure of 98.7 percent. Sixteen (16) states have achieved complete village electrification. Odisha, with 92.88 percent village electrification, lags behind national average by 5.82 percent. Only two districts i.e., Sonepur and Jharsuguda have achieved 100 percent village electrification, while four districts Koraput, Malkangiri, Kandhamal and Rayagada have remained among lowest achieving districts (60-80 percent). The state has 61.21 lakh power consumers in 2015-16 with 79 percent of them are rural users. The rural-urban disparity in consumption of power remains high, detail is given in Table 83.

Table - 83

Sector-wise Distribution of Power Consumers, 2015-16

(in Lakh number)

Sector	Rural Consumer	Urban Consumer	Total	% of Rural consumer to Total Consumers
Domestic	45.56	10.67	56.23	81.02
Commercial	1.45	1.78	3.23	44.89
Industrial	0.04	0.10	0.14	28.57
Others	1.13	0.48	1.61	70.18
Total	48.18	13.03	61.21	78.71

Sources : *CESU, NESCO, SOUTHCO and WESCO*

Major Initiatives in Energy Sector

(a) Biju Gram Jyoti Yojana (BGJY) : The flagship scheme Biju Gram Jyoti Yojana covers those habitations which are not covered under RGGVY to ensure electricity to all. 15,462 nos. of habitations have been electrified during the 11th Five Year Plan against a target of 10,000 habitations.

(b) Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) : This flagship programme of Government of India launched in April, 2005 to provide access to electricity to villages having population of 100 or more. Moreover, 2876149 nos. of BPL kits have also been installed and 2315605 nos. of BPL houses electrified till 2016-17.

(c) Biju Saharanchal Vidyutikaran Yojana (BSVY) : BSVY was launched in 2010-11 for providing access to electricity to the people living in un-electrified areas of urban local bodies. Under the scheme, un-electrified habitations, with minimum population of less than 100 along with BPL household, electrification and system improvement are taken up. Five Municipal Corporations, 45 Municipalities and 61 NACs of the state have been covered under the scheme. During 2015-16, a budgetary provision of ₹ 10.00 crore has been made against which 2346 nos. of villages/wards have been electrified till the end of Jan 16.

(d) CAPEX : CAPEX programme, launched in 2011-12 with an investment of ₹ 2400 crore, aims to improve distribution system, quality of power to the consumers and to reduce AT and C loss.

(e) Energy Conservation : It is a priority issue for Odisha. Major initiatives on energy conservation by Government of Odisha include :

(i) Odisha is the first state in India to notify Odisha Energy Conservation Building Code (ECBC). Energy Conservation Day is observed on 14th December and awareness campaigns are being made among the school students and general public to promote energy conservation issue in the state.

(ii) Implementation of energy efficiency in the 4795 Lift Irrigation (LI) system under the Pani Panchayat is being taken up with OLIC which will work towards grid load reduction as demand side initiatives. Investment Grade Energy Audit (IGEA) is in advance stage of implementation in four major drinking water pumping stations with the support of respective Public Health Divisions. Implementation of high impact street light projects in 106 ULBs of the state by undertaking retrofitting of existing inefficient street lights with LED with associated control systems to demonstrate and showcase benefits of energy efficiencies. LED Village Campaign is in full swing in support of CESU wherein 3 numbers 10W LED bulbs distributed to each family and 20W street lights to selected villages.

(iii) In order to strengthen the Electrical Infrastructure along the Elephant Corridor and thereby to provide safety to the elephants and other wild animals, a special scheme called System Strengthening of Elephant Corridor has been launched.

(iv) OPTCL have authorized to upgrade electricity transmission system and other electrical infrastructures in Puri and its surroundings. The clusters of dedicated agriculture and fishery feeders have been identified and the project implementations have begun through the nodal agency OPTC. For quality supply of power to the consumers and to address the low voltage problem in rural area, it is planned to commission 550 nos. of new 33/11 KV sub-stations within 2017-18. The project work is in progress.

(v) The concept of State Capital Region Improvement of Power System (SCRIPS) is visualized with an objective of 24 × 7 uninterrupted stable power supplies to all classes of consumers including public services.

(vi) Odisha Power Sector Improvement Projects (OPSIP) : The State Government has evolved new schemes and projects like Radial to Ring Conversion Project, Disaster Response Centre, Disaster Resilient Power System, District Headquarter Projects for reliable and un-interrupted power supply to the consumers during natural diaster by adoption of ultra-modern technology and creating new and renovating the existing infrastructure.

Smart Grid : Initiatives are made for adaption of Smart Grid Technology in power sector (Transmission and Distribution Sector).

(vii) Green Energy Development Corporation Ltd. (GEDCOL), a subsidiary of OHPC, which has started its operation from 2013-14 to promote green energy in the state. The project i.e. Odisha Power Sector Externally Aided Project (ADB Project) with "build back better" approach is being launched in the cyclone affected areas of Chhatrapur, Gopalpur and Berhampur of Ganjam district with the ADB loan assistance.

(viii) **Deen Dayal Upadhaya Grama Jyoti Yojana (DDUGJY) :** It aims at strengthening the sub transmission and distribution infrastructure in the rural areas with separation of agriculture and non-agricultural feeders to regulate power supply to agricultural consumers.

(ix) **Integrated Power Development Scheme (IPDS) :** This scheme has been introduced in 2015-16 by Govt. of India in order to create a strong infrastructure for strengthening sub-transmission and distribution network. The roof top solar project, installation of solar panel and smart and net metering are mandatory components under the scheme.

(x) **Radial to Ring Conversion Project :** In this system one substation can be fed from two sources of power which is capable of supplying power at the time of need from other sources to ensure uninterrupted power supply to consumers.

(xi) **Disaster Resilient Power System :** This state scheme is aimed for creation of energy infrastructure having capability to combat the natural calamities like cyclone and flood.

INSTITUTIONS

(a) Grid Corporation of Odisha Ltd. (GRIDCO Ltd) : GRIDCO presently carries out its bulk supply function as a Deemed Trading Utility. Being designated by the State Government as the State Designated Entity for procurement and sale of power in bulk to meet the state demand, GRIDCO procures the state share of power from inside and outside the state and supplies the same in bulk to the Electricity Distribution Companies (DISCOMs) for onward retail sale to the consumers of the state.

Power Scenario

Odisha has 5593.61 MW of installed capacity including its share from central and other sources and including CPPs. The 1st unit of the proposed 2 × 350 MW thermal power plant of M/s. Ind-Barath Energy (Utkal) Ltd. (IBEUL) is likely to supply power (40 MW) during second half of 2016-17. M/s. Monnet Power Company Ltd. (MPCL) is expected to commission their 2 × 525 MW thermal power plant, with Odisha share of 126 MW during 2016-17.

Power Procurement and Sale

During 2015-16, GRIDCO procured 25,277 (approx.) MU of energy at an average rate ₹2.32 paisa per unit at a cost of ₹5858 crore which included renewable energy (solar and non-solar) of about 456 MU. The generating companies from which GRIDCO procured energy are OHPC, OPGC, TIPS, Sesa Sterlite Ltd. GMR Kamalanga Energy Ltd, CGPs, New renewable sources, 8 co-generation, central allocation, trading through power exchanges and purchase through NVVNL. GRIDCO sold around 23,740 MU of energy to the four DISCOM utilities for ₹6524 crore for retail sale to the state consumers.

Power Banking

GRIDCO has been very active in supplying electricity through power banking. During 2015-16 it has transacted about 728 MU of power through power banking. Being a cashless transaction like the one under barter system power banking has helped GRIDCO to balance the states power supply position effectively at the same time.

Power for All

State is actively pursuing along with center and committed to ensure power supply to each household under the "24 × 7 Power for All" by March 2019.

Development of Renewable Energy Sources

GRIDCO has signed power purchase agreements with different renewable energy developers such as small hydro bio-mass and municipal solid waste and waste to energy, etc to maximize the percentage of renewable energy in total energy mix.

New Management of DIDCOMs

Pursuant to the revocation of license of the erstwhile RIL (Reliance Infrastructure Ltd), the management and control of 3 DISCOMs namely SOUTHCO, WESCO and NESCO along with their assets, interests and rights are vested with CMD, GRIDCO with effect from 4th March 2015. Under the new management the performance of 3 DISCOMs utilities is showing sign of improvement.

(b) Odisha Hydro Power Corporation Ltd. (OHPC) : Odisha Hydro Power Corporation (OHPC) Ltd, set up in 1995, has six ongoing Hydro Electric Project at Hirakud, Chipilima, Balimela, Rengali, Upper Kolab, Upper Indravati and one Joint Hydro Electric Project at Machhkund having total installed capacity of 2062 MW which is a distinct improvement over its initial capacity of 1272 MW at the time of incorporation. OHPC provides the cheapest power to the State Grid. During 2015-16, 4104.32 MU of electricity was generated with a gross revenue collection of ₹616.33 crore and gross profit (after tax) of ₹87.30 crore. OHPC is categorized as Gold rated PSU. Plan to develop thermal and hydro renewable energy projects through joint ventures and subsidiary initiated. A 20 MW solar power project has been commissioned at Manamunda, Boudh district. A 15 MW SHEP at Mandira dam, Rourkela is to develop on joint venture with SAIL.

(c) **Odisha Power Generation Corporation (OPGC) :** OPGC is a Government Company and a gold category state PSU incorporated in 1984 and jointly managed by the Government of Odisha and AES, a private US company. It works to establish, operate and maintain electric power generating station, tie lines, sub-stations and transmission lines and connection therewith. It develops and deals in fuels i.e., coal, lignite, coke, coal-bed methane etc. The paid-up share capital of OPGC is ₹490.22 crores, of which, the share of the Government of Odisha is 51 percent. The company has set up two thermal power plants of 210 MW each in Ib valley area of Jharsuguda district at a project cost of ₹1,135 crore. During 2015-16, the corporation generated 3117.32 MU power with Plant Load Factor (PLF) of 84.50 percent with a turnover of ₹705.95 crore and net profit after tax of ₹114.826 crore. OPGCs Thermal Power Station (ITPS) registered a PLF 91.02 percent during the month from April to June-2014 which is the highest among the state-run generating stations of the country as reported by CEA. OPGC is pursuing expansion project with the support of BHEL and BGRE comprising of (2 × 660 MW) power plants in the same location i.e., IB Thermal Power Station (ITPS) and development of captive coal mines in the district of Sundargarh. Details of year-wise turnover and net profits of OPGC have been indicated in Table 84.

Table - 84

Turnover and Net Profits of Odisha Power Generation Corporation (OPGC)

(₹in crore)

Year	Power Generated (in MU)	PLF (%)	Turnover	After Tax Net Profit
2004-05	3160.29	85.90	426.69	143.39
2005-06	3089.61	83.89	448.73	161.91
2006-07	3310.53	89.98	477.07	156.77
2007-08	3043.54	82.72	484.69	165.34
2008-09	3190.63	86.72	440.79	112.48
2009-10	2961.11	80.48	399.88	81.19
2010-11	3184.70	86.56	453.03	115.04
2011-12	2950.15	79.97	572.78	137.08
2012-13	3181.59	86.47	636.03	167.44
2013-14	2855.90	77.62	622.64	127.57
2014-15	2798.92	76.07	630.00	150.57
2015-16	3117.32	84.50	705.95	114.83

***Source** : OPGC*

(d) Odisha Power Transmission Corporation Ltd. (OPTCL) : Odisha Power Transmission Corporation Limited (OPTCL) ensures development of an effective and economical system of intra-state and inter-state transmission lines for smooth flow of electricity from generating station to load center. The infrastructure of OPTCL includes 125 nos. of Grid Sub-stations including Switching station with transformation capacity of 15557 MVA and 12872 Ckt. Kms of transmission lines of 400KV, 220KV and 132KV rating. The present peak demand of the state is around 4000MW, which is handled by the existing network and equipment of the system. Major activities of OPTCL during 2015-16 are outlined as follows:

(i) 1470 MVA transformation capacity augmentation in 22 number of Grid Substations were completed along with 10 numbers of new Grid Sub-stations.

(ii) There are 12 ongoing projects of OPTCL that work on upgradation of conductor, transmission lines, auto transformer capacity, conversion of A/C to D/C lines, installation of capacitor banks, addition of feeder bays, replacement of cold conductor, old and obsolete breakers, CT, PT, LA isolators etc. and construction of LILO lines of different districts.

(e) Odisha Thermal Power Corporation Ltd (OTPCL) : The Odisha Thermal Power Corporation Limited (OTPCL) is a joint venture comapny having equal share with Odisha Mining Corporation Ltd (OMC) and the Odisha Hydro Power Corporation Ltd (OHPC). OTPCL is setting up a coal based super critical thermal power plant of 2400MW (3 × 800 MW) capacity in Kamakhyanagar Tahasil of Dhenkanal district. The total land for the project including the railway corridor after deliberation and visit of CEA is finalized at 1767.908 acres. The cost of the project estimated at ₹16, 174.17 crore i.e., ₹6.74 crore per MW. IDCO has started the initial work for construction of boundary wall, site office, transit house etc.

(f) Odisha Renewable Energy Development Agency (OREDA) : Thermal and hydro-based energy continue to dominate the energy supply sources in Odisha. But the State Government is keen to tap alternative energy sources. The Odisha Renewable Energy Development Agency (OREDA) is the apex agency under the Department of Science and Technology, Government of Odisha. It looks after renewable and alternative energy projects.

Major initiatives of OREDA during 2015-16 are highlighted below :

(i) National Biogas and Manure Management Programme (NBMMP) : The National Biogas and Manure Management Programme (NBMMP) is a high-priority central-sector scheme, and a part of the 20-point programme which educate the people to use biogas for cooking and lighting purposes. It also provides rich organic manure. Against the target of 5100 for 2015-16, 1582 biogas plants are achieved by Feb. 2016.

(ii) Wind Power Project : Odisha has an estimated wind power potential of 910 MW. Wind resource assessment has been taken up at 9 locations. The project is supported by Centre for Wind Energy Technology (C-WET), Chennai, an organization under the ministry of New and Renewable Energy, Government of India.

(iii) **Biomass Power Project :** The Biomass Power Potential of the State has been estimated at 300 MW. One consultant is engaged during 2015-16 for biomass resource assessment study and development of biomass power projects in Odisha.

(iv) **Solar Photo Voltaic (SPV) Power Project :** 25 MW grid connected solar power plants (SPP) has been commissioned in Bolangir district during 2015-16. 25 MW SPP will be installed M/s Acme Odisha Solar Power Pvt. Ltd in Odisha. OREDA installed 50 KW roof top off grid SPP in different government buildings of the state. The state achieved 462.5 KWP under off grid SPV programme. 22812 nos. of solar lanterns have been supplied to handloom weaver's families by the end of Feb, 2016. Proposed target of SPV power plant 1440 KW for 2016-17.

(v) OREDA installed 4852 nos of solar based pump piped water supply scheme from 2013-14. It is planned to install 2000 pumps during 2016-17.

(vi) MNRE released ₹9.33 crore against a state target of installing 2560 number of solar powered pumps with a sanctioned amount of ₹26.75 crore for Odisha under solar pumping programme for irrigation in Odisha during 2015-16.

Energy otherwise known as power is one of the prime movers of any developed economy. Adequate and reliable availability of power is indispensable for sustained growth of the economy. The primary objectives in this sector are optimum utilisation of the power generated, substantial reduction of transmission and distribution losses, maximising generation from the existing capacity and further addition of units to generate more power for meeting the increasing demand for power over the coming years. Besides, optimum utilisation of existing capacity and generation from new units will undoubtedly enable the State to sell power outside the State and thereby earn substantial revenue.

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12

INDUSTRY AND MINERAL RESOURCES

- Industrial Policy-2001
- Iron and Steel Industry
- Aluminium Industry
- Salt Industry
- Coir Industry
- Handicraft and Cottage Industry
- Handloom and Textile Industry
- Seri Culture
- PMEGP
- Export
- Industrial Policy Resolution - 2015
- MSME
- OYIF
- IDCO
- IDCOL
- OK & VIB
- Reserve and Exploration
- Production
- Revenue
- PMKKKY
- Geological Surveys and Exploration
- SEZ
- PPP
- IPICOL
- OSIC
- Mineral Resources
- Exports
- Employment
- OMC

INDUSTRY AND MINERAL RESOURCES

With its abundance of mineral resources, long coastline, plentiful inland waters, diverse forest wealth, Odisha could have become an industry-rich State. The State Government has reaffirmed its commitment for transforming Odisha into a vibrant industrial State and has thus reformulated the Industrial Policy in December, 2001. The main objectives of Industrial Policy (IP) 2001 are :

(i) To create a business climate conducive to accelerate investment in industry and infrastructure projects.

(ii) To raise income, employment and economic growth in the State.

(iii) To reduce regional disparities in economic development.

(iv) To balance utilization of the natural resources for sustainable development.

To achieve objectives set in the Industrial Policy 2001, the State Government aims to:

(i) Encourage private initiative and restrict Government intervention in such areas where it enjoys a distinct comparative advantage.

(ii) Invite private investment for development and operation or quality infrastructure.

(iii) Promote the image of Odisha as an attractive destination for investment and tourism.

(iv) Assume a proactive role in selected sectors such as mineral-based industries, craft-based products, agro and marine-based industries, industries based on medicinal herbs and minor forest produce, tourism, electronics, information technology and biotechnology.

(v) Encourage the creation of small scale industries (SSI) clusters in similar lines of business.

(vi) Proceed more decisively with the restructuring and consolidation of sick industrial units.

(vii) Leverage the potential in Special Economic Zones (SEZs) to build concentration of technologically advanced manufacturing industries.

Location of some Large and Medium scale industries in Odisha.

	Industry	**Location**
1.	Iron & Steel Plant	Rourkela
2.	Fertilizer Plant	(i) Rourkela (ii) Talcher
3.	Mig Factory	Sunabeda
4.	Machine Building	Utkal Mechinary, Kansbahal
5.	Auto India	Rourkela
6.	Paper Mill	(i) Orient Paper Mill, Brajarajnagar (ii) J.K. Paper Mill, Rayagada (iii) Titagarh Paper Mill, Choudwar
7.	Cement Factory	(i) Rajgangpur (ii) Bargarh
8.	Ferro Manganese Factory	(i) Joda (ii) Rayagada
9.	Ferrochrome Factory	Jajpur Road
10.	Ferrosilicon Factory	Thiruvelli
11.	Paradeep Phosphate Limited	Paradeep
12.	Tube Factory	Choudwar

	Industry	**Location**
13.	Sugar Factory	(i) Aska (ii) Bargarh (iii) Raygada
14.	Textile Mill	Choudwar
15.	Spinning Mill	(i) Bargarh (ii) Jharsuguda (iii) Choudwar (iv) Rairangpur (v) Dhenkanal
16.	Glass Factory	Jharsuguda
17.	Refractory	(i) Rajgangpur (ii) Belpahar (iii) Barang
18.	Kalinga Iron Work	Badbil
19.	Re-Rolling Mill	Hirakud
20.	Cable Factory	Hirakud
21.	Industrial Salt Factory	Ganjam
22.	Tile Factory	Choudwar
23.	Aluminium Factory	Hirakud
24.	Caustic Soda Factory	Ganjam
25.	Graphite Crucible Factory	Titlagarh
26.	Heavy Water Project	Talcher
27.	Coach Repairing Workshop	Mancheswar
28.	Cold Rolled Grain Oriented sheet Plant	Rourkela
29.	Indian Rare Earth Project	Gopalpur
30.	Argon Recovery Plant	Talcher
31.	Fero Vanadium Factory	Rairangpur
32.	Charge Crome Plant	Badbil
33.	Sponge Iron Plant	Keonjhar
34.	Odisha Drugs & Chemicals Ltd.	Bhubaneswar
35.	Captive Power Plant	Talcher
36.	Aluminium Complex	Koraput
37.	SAD Complex	Chhatraput
38.	Aluminium Smetter	Talcher
39.	Fertilizer Plant	Talcher
40.	Dying Factory	Jagatpur
41.	NALCO	Angul
42.	Ispat Alloy	Balugaon
43.	IDCOL	Baragarh
44.	FACOR	Bhadrak
45.	RSP	Rourkela
46.	NINL	Dubri
47.	Arati Steel	Jharsuguda
48.	Kalinga Steel (MTPA)	Jajpur Road
49.	FCI	Talcher
50.	Nilachal Ispat Nigam Limited (NINL)	
51.	Jindal Ispat Ltd.	

	Industry	Location
52.	Bhusan Power and Steel Ltd.	Jharsuguda
53.	Sterlite Iron and Steel	
54.	Welspun Power and Steel	
55.	Uttam Galva Steel	
56.	Bhusan, Stainless Ltd	Meramundali

IRON AND STEEL INDUSTRY

The history of modern iron and steel industry in India began in 1870 when the Bengal Iron Works Company set up its plants at Kulti in West Bengal. However, the first effort at largescale Production got underway when the Tata Iron Steel Company (TISCO) was set up at Jamshedpur in 1907. This was followed by the establishment of Indian Iron and Steel Company (IISCO) at Burnpur in 1919. The first unit in public sector now as Visvesvaraya Iron and Steel Limited (VISL) started functioning Bhadravati in 1923. After independence, though development of steel industry was considered during the First Plan, it was only during the Second Plan period that efforts were made to setup three integrated steel plants each with 10 lakh ingot tons capacity at ROURKELA, Bhilai, and Durgapur. An expansion programme to double capacity of the two PRIVATE sector steel plant, namely, TISCO and IISCO to 20 Lakh tons and 10 lakh tons respectively was also taken up. The three plants in public sector came into existence in stages between 1956 and 1959 and the expansion of the private sector plants was completed in 1959. During the Third Five Year Plan, emphasis was laid on the expansion of three public sectors plants and preparation of plans to set up three more steel plants at Salem (Tamil Nadu), Vijayanagar (Karnatak) and Visakhapatna, (Andhra Pradesh) to create additional steel production capacity in Fifth Plan.

Steel Authority of India Limited (SAIL) is a wholly owned government undertaking. It is responsible for the management of Steel Plants at Rourkela, Bhilai, Durgapur, Bokaro and Burnpur and also the Alloy Steel Plants at Durgapur and the Salem Steel Plant. The management of IISCO was taken over by the Government on 14th July 1976 with a view to improving its working. The company is now a wholly-owned subsidiary of SAIL. SAIL took over Maharastra Elektrosmelt Limited, a ministeel plant producting ferro-manganese and steel in January 1986. Visvesvaraya Iron and Steel Limited, a unit controlled by the Karnatak Government was taken over by SAIL in August 1989. Authorised capital of SAIL and paid up capital as on 31 March 1995 was ₹ 5000 crore and ₹ 3,985,89 crore respectively.

HINDUSTAN STEEL LIMITED (HSL) ROURKELA (ODISHA)

The Hindustan Steel Ltd.'s plant at Rourkela is situated on the Calcutta-Bombay rail route nearly 160 km to the west of Jamshedpur under public sector. All major raw materials except coal are available in close proximity around this centre. The water is available from the river BRAHMANI. Iron-ore is obtained from BONAI and TELDIHI.

Comparative Study of Production of Iron and Steel Plants

(in thousand tons) (1994-95)

Plant	Crude Steel	Saleable Steel
SAIL		
Rourkela Steel Plant	1,456	1170
Bhilai Steel Plant	.3925	3153
Durgapur Steel Plant	1,250	1000
Bokaro Steel Plant	4,000	3156
Salem Steel Plant		70

Source : India, 1995, Published by the Govt. of India.

Limestone is obtained from Biramitrapur near Rourkela. Manganese comes from Jamada and Bonai. Cooking coal, of course is obtained from the distant fields of Jharia and Raniganj. But the goods-train carrying iron ores, limestone, dolomite and manganese from this area to the Damodar Valley Steel towns can RETURNWITH COAL for Rourkela. Moreover, the coal of Talcher (Odisha) can profitably utilized as coke if it is mixed up with those of Jharia and Raniganj. It also receives electricity from Hirakud Project. It was set up in collaboration with the German firm, Krupps and Demag and the first blast furnace was commissioned in 1959.

Rourkela has adopted the Linz and Donawitz (LD) process of steel making. It is only centre in India where steel is produced by LD conversion process. Through this process large quantity of nitrogen is derived as by-product, as a result of which a Fertilizer Plant has been established here. During 1989-90 the HSL produced 1,110,000 tons of crude steel and 1,120,000 tons of Saleable steel. But in 1994-95, the production of crude steel has increased amounting to 1,178,000 tons and the saleable steel has increased to 1,201,000 tons. The New Industrial Policy announced in July, 1991 has removed iron and steel from the list of industries reserved for the public sector, and also exempted it from the requirements of compulsory licensing. Entrepreneurs are therefore,free to set up steel plants of any capacity, subject to certain locational restriction. Iron and Steel has also been placed in the list of high priority industry, subject to certain conditions, automatic approvals are available for foreign equity up to 51%, and for technology agreement up to specified limits. There has been very positive response from the entrepreneurs.

Rourkela has a good natural setting girdled by vardant hill and encircled by three rivers. The modern Steel Township at Rourkela extends an air of friendliness and tranquility. The hill range separates the township from the plant providing a natural screen to cut off the smoke and din of the plant. The growth of Rourkela from a tiny unknown village to one of the most modern temples of steel and technology has been a history of trials and tribulation interspersed with moments strees and periods of success and glory having all the ingredients of a complete human drama.

ALUMINIUM INDUSTRY

Among all the industries, aluminium industry is perhaps youngest. Aluminium was discovered only 1986. In the manufacturing of aluminium, bauxite, the principal ore, has to undergo crushing, washing, heating and removal of impurities after applying caustic soda. The use of aluminium is ever increasing particularly because of the important characteristics like strength with light weight, good electrical conductivity, excellent corrosive resistance, low melting point, high reflectivity, non-toxic, non-magnetic properties, attractive appearance, decorative finish, light scarp value and availability of rolled and extended products.

Recent discovery of huge deposits of high grade bauxite has put Odisha in the world map of minerals. To exploit enormous quantity of bauxite-ore a Giant Alumina-Aluminium Complex has been set up at Damonjodi of Koraput district and Angul district.

It is giant Public Sector Undertaking promoted by National Aluminium Company (NALCO), Government of India with the collaboration of M/S Aluminium Pechiney, France with an investment of ₹ 2408. 14 crores. It was commissioned in 1984.

The poduction of aluminium is done in TWO phases :

1. Production of alumina from bauxite (Alumna Plant).

2. Conversion of alumina (Smelter plant) into aluminium ingots. The location of alumina plant depends on availability huge quantity of bauxite ore and power supply. The smelter plant requires huge amount of un-interrupted poor supply besides alumina.

Alumina is lighter than bauxite so it is easier to transport to such places having ample power supply. Aluminium is a power oriented industry either of hydel power or thermal power. More than 20 to 25% of the cost of production is accounted for the purchase of power. So the availability of power at cheap rates and its un-interrupted supply is essential for aluminium industry. Thus the availability of bauxite ore near the alumina plant and power generating units located in the proximity of aluminium smelter plant is the OPTIMUM SITE for aluminium industry.

After considering above factors, NALCO was set up as giant Alumina-Aluminium complex. The NALCO complex comprises FOUR Units.

1. Panchapatmali bauxite mine
2. Alumina Plant at Damonjodi
3. Alumina Smelter at Angul.
4. The Captive Power Plant at Angul.

1. Panchapatmali Bauxite Mines : Transportation of bauxite from the Panchpatmali bauxite mines to the Alumina Plant having an altitude of 340 metres falling over a very difficult undulating terrain with an annual capacity of 2.4 million tons was the toughest challenge for the technocrats. Bauxite is problematic because of its sticky nature when wet

Table - 61
Production of Aluminium

(Unit : lakh MT) (2015-16)

Name of the Company	Cumulative Production Target	Cumulative Production as on March - 2016
NALCO	3.74	3.72
BALCO	5.18	3.31
HINDALCO	4.05	4.09
VEDANTA Ltd.	5.46	5.16
TOTAL	**18.43**	**16.28**

Salt Industry

Odisha is bestowed with a long coast line of about 480 kms which runs along with west of Bay of Bengal. At present, salt is manufactured in our state in coastal districts of Ganjam, Puri and Balasore. There are 3 nos. of registered working co-operative societies engaged in salt production along with 39 licenses in private sector over an area of Ac.5137.248. Financial Assistance is provided for improvement of salt field, infrastructure facilities like construction of storage godown, purchase of pump set, sinking of bore well for getting sub-oil brine for augmenting salt production etc. Details of salt production are given in Table 62.

Table - 62
Salt Production (Sector Wise) with Value and Employment Generation in Odisha

(Area in Acre and Production in MT)

Year	Govt. Sector		Co-op Sector		Private Sector		Total		Value	Employ-ment
	Area	Production	Area	Production	Area	Production (crore)	Area	Production	(₹ in)	
2010	–	–	1324	3354	3813	11262	5137	14616	1.75	4500
2011	–	–	1324	1690	3813	5710	5137	7400	1.11	350
2012	–	–	1324	7216	3813	26729	5137	33945	4.07	4200
2013	–	–	–	3060	–	7700	5137	19327	–	1600
2014	–	–	–	3557	–	6490	5137	10047	–	1585
2015 (upto Dec 2015)	–	–	–	–	–	–	5137	442	–	–

***Source** : Director of Industries, Odisha*

Besides, for undertaking developmental and labour welfare works, centrally sponsored schemes are being implemented under joint venture of Government of India and State Government. Under this programme, construction of school builiding, provision of scholarships to the meritorious students etc. have been taken up to extend educational facilities to the children of salt workers. Health centres with medical facilities have been provided to salt worker for improvement of health. Under the scheme 'Namak Majdoor Awas Yojana' 244 dwelling units have been constructed for providing shelters to the bonafide salt workers. Drinking water facilities are also being provided in the nearby vicinity of the salt producing area.

Coir Industry

There is ample scope for development of coir industries in Odisha having a coast line of 480 kms. The status of coir industries for the year 2015-16 is given in the Table 62 (A).

Table - 62(A)
Status of Coir Industry

Sl.No	Description	Unit	2015-16
1	Coconut Cultivation	Hectare	51035
2	Coconut Production	Lakh	2750
3	Coir Fiber Production	MT	4140
4	Government Training Centre State Level 1 year advanced course District Level 6 months Artisan Course Annual intake capacity No. of trained		 1 3 150 1985
5	Cooperative Societies No. of working societies Membership		 13 6362
6	Coir Cluster Development No. of coir cluster SHG promoted Artisans under SHG fold		 70 270 4049
7	SSI units	Number	201
8	Micro Enterprises.	Number	685
9	Total Employment	Number	11150
10	Production of coir fiber, coir goods per annum including rubberized coir.	₹ in crore	102.07
11.	Field Training Centres F.T.Cs Trained personals	 Number Number	 25 500

Sl.No	Description	Unit	2015-16
12	Artisans deputed on exposure visit	Number	407
13	Infrastructure assistance provided to Co-operative Societies	Number	08
14	Infrastructure assistance provided to SHGs	Number	23

Source : MSME Activity Report 2015-16, Govt. of Odisha

Handicrafts and Cottage Industry

Odisha has acquired to incomparable fame for its cottage and handicrafts products. People of the state have achieved an excellent legacy in preparing these products. The state in fact is considered as the land of handicrafts which is an indispensable part of our cultural heritage. As many as 50 different crafts are practiced by about 1.30 lakh artisans, dispersed throughout the state. The handicrafts sector constitutes a significant segment of the decentralized sector of the state's economy. It provides employment to lakhs of artisans in rural and urban areas especially in the weaker sections of our society with less capital investment. Many artisans of the state have been honoured with National Awards including Padma Awards in different crafts. During 2015-16, 2278 cottage industries have been established and gone into production with an investment of ₹ 8.44 crore and providing employment to 3,867 persons (Table - 63).

Table - 63

Growth of Handicraft and Cottage Industry in Odisha

Year	No. of units established during the year	Investment (₹ in crore)	Employment Generated (no.of persons)
2011-12	7923	30.31	9187
2012-13	1027	2.96	1393
2013-14	1204	3.45	1507
2014-15	1596	7.15	1952
2015-16	2278	8.44	3876

Source : *Director of Handicrafts and Cottage Industries, Odisha*

It is realized that with development and modernization, there has been a transformation, in peoples' choice from the products of the cottage industries to alternative products available from other sources. In order to entice this issue, State Government have taken various measures for strengthening infrastructure and financial base of this sector by assisting co-operatives and artisans to intensify production and sale. During 2015-16, bank credit amounting to ₹ 70 lakh has been released to 808 numbers of artisans assisted under Rehabilitation of Handicraft and Artisans (RHA) scheme. Besides, 54 clusters covering 1710 artisans in 114 SHGs have been assisted under craft village scheme. A new scheme "Modernization and Technologies Up-gradation of Handicraft Industries" is being implemented in the state since

13 to enhance the productivity and to facilitate mass production in handicraft sector. nder this scheme, 60 numbers of entrepreneurs have availed subsidy amounting to ₹ 90.00 during 2015-16. Marketing assistance is being provided to co-operative / SHGs / ividual artisans through exhibitions organized inside as well as outside the state. During 5-16 about 2380 artisans participated in more than 84 different exhibitions / melas luding 51 district level and 5 state level exhibitions with a sales turnover of ₹1740.98 lakh. e Departmental Training Centers established at State / District level play an important role eating new generation craft persons with adequate skill. Under this training programme, 0 candidates have completed the training and 296 candidates are under training during 5-16. For promotion of handicraft industries a scheme "Construction of work shed-cum-using for Handicraft Artisans" was introduced during 2013-14, to provide a hygienic vironment, well ventilated and naturally lighted working place to artisan's families to hance their productivity. Under this scheme during 2015-16, 64 nos. of work-sheds have een sanctioned against a target of 89 in 31 District Industries Centres (DICs) of Odisha.

The scheme "Distribution of Solar Lanterns to Artisans Households" has been roduced for artisans to work for more time and increase productivity for their sustained elihood. During 2015-16, total 14137 numbers of Solar Lanterns have been distributed to tisan households against the target 9000 with a budget provision of ₹136.17 lakhs. During 15-16, it was targeted to provide insurance coverage to 14000 handicraft artisans with emium amount placed with LIC and 15872 handicraft artisans have been covered. For vival and strengthening 28 handicraft cooperative societies during 2015-16, financial support f ₹75 lakh has been released to 13 no. of DICs. Apart from 1 year certificate course in Craft Design at SIDAC and a 4-month design led training programme at Balasore, 5 nos. of Design Development Programmes involving 125 artisans have been conducted in districts hrough SIDAC and concerned DICs / RICs. During inauguration of 10th Toshali National Crafts Mela on 15.12.2015, four eminent handicraft artisans and nine artisans have been onoured with Life Time Achievement Award and State Award respectively.

HANDLOOM AND TEXTILE INDUSTRY

Handloom Sector

Handloom sector, next to the agriculture provides massive employment to the rural artisans handloom occupies a significant place in preserving the state's heritage and culture. The handloom products of Odisha have received national and international recognition for highly artistic designs, craftsmanship and durability of their products. As per the census conducted in 2009-10, there were 40,683 weaver households having 43,652 looms, with a population of 192,339 weavers in the state. There were 1,140 Primary Weavers Co-operative Societies (PWCS) by the end of 2015-16 of which 530 were working PWCs, 33 nos. are dormant and 577 were under liquidation. During 2015-16, out of 38874 looms in working PWCS, 22765 were working looms which produced 131.02 lakh sq. mtrs of handloom products valued at ₹ 246.97 crore. During 2015-16 about 126.95 lakh sq. mtrs of hand loom products valued at ₹ 240.02 crore were sold of which 22.11 lakh sq. mtrs were silk products valued at ₹ 101.06 crore. The productivity per loom per annum during 2015-16 stood at 576 sq.mtrs in the co-operative fold as against 553 sq.mtrs in 2014-15 while the average earning per annum in the co-operative fold increased from ₹ 37546 to ₹ 43894 during the same period.

The State Government have implemented some major developmental and welfare schemes to improve the socio-economic conditions of weavers such as promotion of handloom industries, Integrated Handloom Development Scheme, Cluster Development Programme, Group Approach, Marketing and Export Promotion Scheme, Health Insurance Scheme and Mahatma Gandhi Bunakar Bima Yojana. Besides, weavers are being provided with work shed, skill upgradation training and weaver's photo identity card. Technology, upgradation, construction of common facility centre, exposure visits, organisation of exhibitions, design interventions and publicity have infused new spirit in the clusters. Sales of handloom products have been on an upswing and new inroads are being made in penetrating the national and international markets. The "Indian Institute of Handloom Technology" has been set up and functioning in Bargarh. A special project "Design Reference for Collection of Odisha Handloom" is under implementation with involvement to establish a sustainable market linkage with buyers of inside and outside the country. Similarly, "Odisha Artisans and Weavers Ltd." have been set up in association with a leading retail brand like 'fab India' to provide endurable and continuous business in the sector. Government have taken positive steps for registration of Odisha 'ikat' product under Geographical Indication (GI), to protect the weavers from competition in various fields.

Sericulture Sector

The state has a rich traditional heritage of Tassar culture adopted mostly by tribal farmers concentrated in different 14 forest rich districts of the state. About 46,828 no's of SC / ST families are practicing tassar culture in Odisha. During 2015-16 tassar food saplings were planted in 15370 hectares of land and 20.14 lakh Dfls were produced. During the year, 1220.80 lakh reeling cocoons, 107.00 MT raw silk and 20 MT of silk waste were produced in the state. Sericulture is an agrobased industry, providing employment to the rural poor on a large scale. Eri rearing is traditionally cultivated in 15 districts. During 2015-16, castor plantation was made over 1405 acres with 2810 beneficiaries. During 2015-16 the production of cut cocoons was 8.90 M.T which was 10.22 M.T during 2014-15. The production of raw silk was 7.0 M.T during 2015-16. Mulberry sericulture is non-traditional in the state and is practiced in 12 districts. During 2015-16, mulberry area in the state was about 1460 acres and 25.94 MT of reeling cocoons, 3.00 MT raw silk and 0.30 MT of silk waste were produced in the state involving 1465 SC / ST farmers. The annual report is shown at Table 64 which provides a glimpse into the efforts put in and the output achieved in sericulture sector.

Table - 64

Achievements of Tassar, Mulberry and Eri Sectors

Activities	2014-15	2015-16
Tassar Sector		
Tassar Food Plants (Ha)	13835	15370
Production of Dfls (lakh nos.)	17.40	20.14
Procurement of Dfls (lakh nos.)	4.70	5.06
Consumption of Dfls (lakh nos.)	22.10	25.20
Production of reeling cocoons (lakh nos.)	1009.12	1220.80
Production of raw silk (M.T.)	88.30	107.00
Production of silk waste (M.T.)	17.00	20.00
No. of farmers covered (Nos.)	13919	15486
Mulberry Sector		
Mulberry area in Acre	1157	1460
Procurement of Dfls (lakh nos.)	1.32	1.34
Consumption of Dfls (lakh nos.)	1.32	1.34
Production of reeling cocoons (lakh nos.)	25.50	25.94
Production of raw silk (M.T.)	3.18	3.00
Production of silk waste (M.T.)	0.318	0.30
No. of farmers covered (Nos.)	1209	1465
Eri Sector		
Existing Castor Plantation (Ac)	1345	1405
Consumption of Dfls (lakh nos)	1.72	1.57
Production of cut cocoons (M.T.)	10.22	8.90
Production of raw silk (M.T.)	7.00	7.00
No.of farmers covered (Nos.)	2690	2810

Source : Director of Textile, Odisha

To support sericulturists in tassar, eri and mulberry sector, several schemes under promotion of sericulture industry (state plan and state share of CSP) and CSS of Central Silk Board are under implementation. Under the scheme, the farmers are being provided with improved technology for High Yielding Variety Food Plant, HYV DFLs, Chawaki worms, Rearing houses, Rearing equipments, Grainage Houses, disinfectants and marketing support. Besides technology upgradation, exposure visit and trainings were carried out for farmers and private grainceurs to improve the productivity.

Prime Minister's Employment Generation Programme (PMEGP)

This centrally sponsored scheme provides credit-linked subsidy and aims at generating employment opportunities through establishment of micro enterprises in rural and urban areas. During 2015-16 against the target of releasing ₹ 62.82 crore in favour of 3141 units, 25380 applications were received and ₹ 57.36 crore was sanctioned in favour of 2876 units.

Exports

During 2015-16, 31 SSI units have been registered with the Directorate of Export Promotion and Marketing, Odisha and ₹ 51.15 thousand have been collected towards registration fee. 11013 samples were tested in six departmental testing laboratories and ₹ 51.40 lakh of testing fee was also collected. Table 65 shows the value of goods exported from 2009-10 to 2015-16 (Table 65).

Table - 65

Value and Percentage of Goods Exported from Odisha to Foreign Countries from 2009-10 to 2015-16

(Rs. in crore)

Item	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Metallurgical products	4561.77	4807.98	4806.68	5211.38	7677.49	10836.98	10814.08
%	35.93	28.12	29.66	49.08	40.88	62.92	62.34
Engineering, chemical and allied products	718.70	612.62	196.21	61.00	3531.21	3330.73	1294.67
%	5.66	3.58	1.21	0.57	18.80	19.34	7.46
Mineral products	5740.14	9836.84	9259.48	2427.57	3546.78	705.79	539.44
%	45.21	57.53	57.13	22.86	18.89	4.10	3.11
Agriculture and forest products	4.17	8.77	0.02	0.05	02.92	03.34	0.47
%	0.03	0.05	0.00	0.00	0.02	0.02	0.00
Marine products including fish and shrimps products	446.80	541.47	521.34	747.30	1699.41	1771.86	1967.07
%	3.52	3.17	3.22	7.04	9.05	10.29	11.34
Handloom and textile products	19.43	28.96	0.02	0.01	10.64	84.09	18.10
%	0.15	0.17	0.00	0.00	0.06	0.49	0.10

Item	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Handicraft products	0.43	0.71	0.17	0.17	0.27	0.10	0.22
%	0.01	0.00	0.00	0.00	0.001	Neg	0.00
Electronics	1198.84	1254.24	1414.78	2169.94	2300.46	476.12	2700.00
%	9.44	7.34	8.73	20.44	12.25	2.76	15.57
Others (Computer software, Gems and Jewels, Service provide and pharmaceutical etc.)	6.15	7.29	8.64	0.02	10.93	14.53	12.43
%	0.05	0.04	0.05	0.00	0.06	0.08	0.07
Total	12696.43	17098.88	16207.35	10617.43	18785.45	17223.54	17346.48 (P)
%	100.00	100.00	100.00	100.00	100.00	100.00	100.00

P : Provisional

Source *: Director of Export Promotion and Marketing, Odisha*

The Table 66 indicates the export composition in terms of values during 2015-16.

Table - 66

Itemwise Exports of Goods from Odisha, 2015-16

Sl.No	Name of the Products	No of Countries to which Exported	Value in ₹ Crores
1	Metallurgical	40	10814.08
2	Engg./Chemical and Allied	79	1294.67
3	Minerals	5	539.44
4	Agriculture and Forest	4	0.47
5	Marine	39	1967.07
6	Handloom	13	0.87
7	Handicraft	7	0.22
8	Textile	2	17.23
9	Pharmaceutical	3	02.31
10	Electronics and Software	6	2700.00
11	Gems & Jewellers	–	0.50
12	Service Providers	All foreign countries	09.62
	Grand Total		**17346.48 (P)**

P : *Provisional*

Source : *Director of E.P. & M, Odisha*

Industrial Policy Resolution (IPR) 2015

After Industrial Policy (IP) 2001, IPR - 2015 was formulated. The Industrial Policy Resolution 2015 was formulated to create a conducive environment through an enabling policy and regulatory framework to drive sustainable industrial growth in the state. The state is commited to simplify the processes and procedures and expedite project approvals and clearances. The emphasis of the policy is to make Odisha "a destination of choice" for industrial enterprises.

For faster industrial development in the state the IPR 2015 emphasizes on strengthening institutional and regulatory mechanisms. The three tier single window clearance system at State, Region and District level expects to maximize the triple objectives of value addition, employment generation and revenue augmentation through industrialization. IPICOL is the Technical Secretariat and Nodal Agency of Team Odisha and the State Level SWCA. The IPR 2015 offers wide range of proposals for social and urban infrastructure, HRD, labour reform, marketing support to MSME, revival of sick units, export promotion and monitoring plan etc. Besides improving existing industrial parks, estates and areas in the state, it aims to develop new industrial estates, parks, areas, growth centres by IDCO, OIIDC and PPP under a comprehensive land zoning plan. Establishment of National Investment and Manufacturing Zones (NIMZ) at Kalinganagar, Dhamra and Gopalpur, Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) in Jagatsinghpur and Kendrapada districts and a SPV Paradeep investment development region limited shall add to the state industrial cluster remarkably.

MSME Development Policy - 2015

Odisha MSME Development Policy 2015 aims to attract new investments and provide support to the existing enterprises and the frame work has been divided as enabling, supporting and incentive frame work. The new IPR-2015 targets some of the fiscal incentives towards MSME's such as, providing land at concessional rates, interest subsidy, exemption of stamp duty, VAT reimbursement, assistance for technical knowhow and marketing supports and many more. The main emphasis of this new MSME policy is to make Odisha "a destination of choice" for MSME enterprises. The main objectives of this new policy are :

(i) Enhance competitiveness of MSME sector.

(ii) Provide a conducive eco-system to attract and encourage new investments.

(iii) Provide opportunities to local entrepreneurial talents.

(iv) The growth of MSME all potential sectors of the economy and focused on sustainable industrial growth.

(v) Enhance the contribution of MSME's in manufacturing and services sector of the economy.

(vi) To achieve the above objectives some strategies have been designed such as

(vii) Single-window facilitation cell.

(viii) Cluster development approach.

(ix) Facilitate setting up ancillary and downstream units of existing and upcoming large industries.

(x) Flow of credit and industry institution linkage etc.

Special Economic Zone (SEZ) Policy 2015

SEZ is specifically designated as a duty-free enclave and treat as a foreign territory for the purpose of trade operations, duties and tariffs. The prime objectives of SEZ is to stimulate more efficient use and value addition of local resources; attract investments; increase export of goods and services; develop world class infrastructure; create centres of excellence for manufacturing services and other economic activities; increase employment opportunities; improve the skills; facilitate transfer of technology and modern management skills to local enterprises; provide need-based incentive package to SEZ Developers etc. For Odisha, the SEZ approach offers a flexible strategy to expand its industrial and economic base and result in incremental employment opportunities. The SEZ in Odisha will be developed both by public and private sector developers individually or jointly. The developer will plan, develop, finance, manage, market and maintain the zones. The thrust areas of SEZ shall include sectors like IT, ITES, Biotechnology, electronic systems and manufacturing, automobiles and component manufacturing, engineering goods, textile and handlooms, agro based and marine products, ship repairing and building, gems and jewellery, petroleum and its products, pharmaceuticals, tourism and primary metal based downstream and ancillary industries etc.

Single Window Concept and Public-Private Partnerships (PPP)

The Public-Private Partnership mode is emboldened in the state to mobilize the private sector efficiencies for the development of economic and quality infrastructure in the state. Some of the PPP projects that encourages value addition and employment creation are:

(i) Establishment of an Info Park in Bhubaneswar.

(ii) Up-gradation of industrial infrastructure at Kalinganagar and industrial complex through Odisha Industrial Infrastructure Development Corporation (IDCO) and user industries.

(iii) Development of Haridaspur-Paradeep Rail Link jointly by Rail Vikas Nigam Limited and user industries.

(iv) Promotion of Special Economic Zones (SEZ) at different locations.

(v) Establishment of a Bio-Tech Park.

(vi) Development of the second INFOCITY for establishment of IT industries in Bhubaneswar and for promotion of export oriented industrial units.

MAJOR STATE-LEVEL INSTITUTIONS

Odisha Industrial Infrastructure Development Corporation (IDCO)

IDCO is acting as the Nodal Agency for providing industrial infrastructure and land for industrial and infrastrucutre projects in the state. The corporation is engaged in industrial infrastructure development work for rapid industrialization in the state. Industrial Estates and Industrial Areas IDCO has already developed 106 Industrial Estates / areas in different strategic locations.

Industrial Promotion and Investment Corporation of Odisha Ltd. (IPICOL)

As the State Level Nodal Agency, IPICOL have taken pro-active measures for investment promotion and industrial facilitation in the state. IPICOL have made relentless effort convert Odisha to an industrially vibrant state and making it a favourite destination for investors. The IPICOL has been able to attract a large number of investment proposals. The major activities of IPICOL after being declared as SLNA under Odisha Industries Facilitation Act, 2004, are to extend Single Window Facilitation services to investors and to take up promotional activities for the state. In the year 2015-16, thirty two (32) meetings of State Level Facilitation Cell and eight (8) meetings of State Level Single Window Clearance Authority (SLSWCA) have been held to approve project proposals. In 2015-16, twenty three (23) Nos. of project proposals have been cleared by State Level Single Window Clearance Authority (SLWCA) aggregating proposed investment of ₹ 4408.12 crores. Besides seven (7) nos.of project proposals have been cleared by High Level Clearance Authority (HLCA) aggregating proposed investment of ₹ 41900.61 crores.

The investment promotion wing of IPICOL has taken up the following key activities towards attracting investment to the state.

(i) Focused group discussions were organized across the country to collect the feedback from various industries representatives for taking inputs for the long term roadmap for industrial development in the state.

(ii) IPICOL drives the Make in India, Ease Of Doing Business (EODB) program and the state is placed 7th in the World Bank ranking of Ease of Doing Business. The state aspires to be in top 3 positions in next year ranking. IPICOL is driving the same to achieve the goal set by the State Government.

(iii) A document has been prepared on downstream industries for industrial hubs at Paradeep, Kalinganagar, Jharsuguda, Rourkela, Dhamra, Angul, Gopalpur for attracting large-scale investment in the downstream industries.

(iv) The IPICOL has constantly and consistently increased the visibility of the State in National and International level. A large number of investment propotion events have been organized / participated by IPICOL under 'Invest Odisha' banner.

Odisha Industrial Infrastructure Development Corporation (IDCO)

IDCOL was set up in 1962 to support large and medium scale industries in the state. It has set up 15 industry units in the state. As a part of the Public Sector Reforms Policy of the Government divested many industrial undertaking, sick subsidiary companies were disinvested or assets were sold. Presently, it continues as the holding company of the following subsidiary companies:

(i) IDCOL Kalinga Iron Works Ltd. (IKIWL) at Barbil, engaged in manufacturing foundry grade pig iron and cast iron spun pipe.

(ii) IDCOL Ferro Chrome and Alloys Ltd. (IFCAL) at Jajpur Road, which produces High Carbon Ferro Chrome (HCFC).

(iii) IDCOL Software Ltd. at Bhubaneswar which acts as one of the nodal IT agents of the Government.

As on 30th November, 2014 the corporation provided employment to about 1049 persons directly and indirect employment to about 1534 persons in its wholly owned subsidiary companies. IDCOL operates Roida 'C' Iron Ore and Manganese mines.

Odisha Small Industries Corporation (OSIC)

OSIC has been established with the main objective to aid and assist the MSMEs units in their all-round growth and development. The corporation has been administering various schemes like

(a) Consortium Marketing.

(b) Raw Material Assistance.

(c) Brand Building and Marketing.

(d) MSME Infrastructure Development and various other Govt. Schemes for the MSMEs of the state.

Apart from the above activities, OSIC has been undertaking civil construction activities, Rural Electrification work and supply of Bitumen and Tata Tiscon bars fpr construction of roads and houses respectively in all corners of the state.

Under Raw Material Assistance Scheme, OSIC provides various types of raw materials to MSME units through 12 raw material depots spread all over the state. Presently, it deals with the raw materials like iron and steel, TISCON bars, aluminum ingots, plastics, bitumen and coal and has appointed 330 dealers to spread its TISCON bar business. The corporation achieved a turnover of ₹ 449.81 crore during 2015-16.

Under Marketing Assistance Scheme, it provides product and project marketing assistance to small-scale units and participates in tenders and liaison with public and private sectors for procurement of bulk orders. Its main marketing products include agricultural implements and dual desks. The corporation has entered into Rural Electrification works through CESCO, WESCO and NESCO since 2006-07. It is worth mentioning that OSIC achieved a turnover of ₹ 83.99 crore during 2015-16.

Odisha Khadi and Village Industries Board (OK and VIB)

Odisha Khadi and Village Industries Board is a statutory organization constituted for organizing, developing and regulating Khadi and Village Industries in the state with a view to provide gainful employment to rural artisan and economically backward class of people. The Khadi and Village Industries Commission, Mumbai, provides fund for implementation of schemes as per guidelines issued by KVIC, Mumbai time to time. The establishment expenses of the board have been borne by the Govt. of Odisha. Under this programme, during 2015-16 the board has provided margin money of 16.25 crores for establishment of 777 village industries and generated employment to 5618 persons. The target and achievements under 2015-16 and 2016-17 (upto 30.06.2016) is given in Table 67.

Table - 67

Progress under PMEGP Scheme by KVIB from 2011-12 to 2015-16

(Employment in No. and Margin Money Ruppes in lakh)

Year	Target			Achievement		
	No.	Margin Money	Employment Generated	No.	Margin Money	Employment Generated
2011-12	905	1266.26	9050	678	1274.85	5333
2012-13	1036	2381.28	8288	1184	2314.54	9529
2013-14	1036	2381.28	8288	641	1315.08	4843
2014-15	1576	2177.59	12608	626	1374.79	4602
2015-16	718	1434.60	5744	777	1624.79	5618

Source : *Odisha Khadi and Village Industries Board*

Odisha State Financial Corporation (OSFC)

Odisha State Financial Corporation (OSFC) came into existence in 1956 after incorporation of the SFCs Act by the Parliament in 1951. OSFC is a state level pioneer institution engaged in financing micro, small and medium scale industries in the state. It provides loan assistance for setting up industries in tiny, small and medium scale in consortium finance with commercial banks. It extends term loan up to ₹ 10.00 crore per project/unit for acquisition of fixed assets for setting up industrial units. Besides, the corporation extends financial assistance for expansion, diversification, modernization and revival of potential viable units. The credit delivery net work of OSFC is being taken up by its 9 branches.

In its 60 years of operation, the corporation has disbursed ₹ 1310 crore to 28222 micro, small and medium scale industries resulting in direct employment for more than two lakh people in various sectors such as iron and steel, hospitality and healthcare, transport, agro based etc. It also created scope for self employment. In fact, SFC created seed-bed for the first generation entrepreneurs.

MINERAL RESOURCES

Minerals are essentially the raw materials for infrastructure, capital goods and basic industries. The extraction and management of minerals have to be integrated into the overall strategy of the state's economic development. Assured availability and proximity of mineral resources play an elemental role in giving a competitive edge to the state's industry. The multiplier effect of minerals processed into metals on downstream industrialisation cannot be ignored. Mining and quarrying sector shares 7.3 percent of GSDP of Odisha. It generates about 0.49 lakh direct employment in mineral based industries in the state. The sector provides sizable fiscal resources as taxes and royalties.

Minerals in Odisha

Odisha is a mineral rich state with large varieties of metllic and nonmetallic minerals which include chromite, bauxite, graphite, iron ore, manganese ore, limestone, clay, quartz and quartzite, nickel, copper, lead, coal and many precious stones. Minerals in Odisha contribute multi dimensionally to its economy. The State Government of Odisha envisions achieving optimal utilisation of State's mineral resources for its industrial growth and socio-economic development, through scientific exploration, sustainable mining practices and geo scientific research.

Mineral Reserves and Exploration

Odisha has been richly endowed with vast resources of a variety of minerals and therefore occupies a prominent place in the country as a mineral rich state. By 2015-16 it could be known from surveys that about 92 percent of chromite, 52 percent of bauxite, 35 percent of manganese, 33 percent of iron ore, 92 percent of nickel and 24 percent of coal deposits of India are located in the state. Among the major minerals, Odisha has 757860.5 million tonnes of coal, 171.5 million tonnes of chromite, 5692.83 million tonnes of irone ore, 1895.11 million tonnes of bauxite and 1765 million tonnes of lime stones reserves. Table 68 reflects a picture on total reserves, exploration and rate of exploration of important minerals in the state during 2012-13 to 2015-16.

Table - 68

Total Reserves, Exploration and Rate of Exploration of Important Minerals During 2012-13 to 2015-16

Minerals/ Ores	Total Reserves in 2015-16(P)	Exploration in Million tonnes during				Rate of Exploration to total reserves (%)			
		2012-13	2013-14	2014-15	2015-16	2012-13	2013-14	2014-15	2015-16
Iron ore	5692.83	62.93	77.784	53.33	80.87	1.27	1.36	0.93	1.42
Chromite	171.49	2.88	2.855	2.16	3.10	1.8	1.62	1.24	1.81
Coal	757860.53	109.68	108.175	122.76	138.55	0.15	0.14	0.02	0.02
Bauxite	1895.11	5.46	7.635	9.19	10.84	0.3	0.41	0.49	0.57
Lime stone	1764.45	3.90	3.716	3.41	4.52	0.39	0.21	0.19	0.26
Dolomite	682.54	1.02	0.687	0.46	1.04	0.31	0.10	0.07	0.15
Fire clay	170.08	–	–	0.00	0	0.0	–	0.00	0
Quartz, quartzite,etc	134.26	0.03	0.04	0.03	0.05	0.04	0.04	0.02	0.04
Mineral sands	266.38	0.23	0.179	0.24	0.226	0.1	0.07	0.09	0.08
Graphite	8.59	0.01	0.010	0.01	0.18	0.15	0.12	0.12	2.10
Manganese ores	189.66	0.53	0.663	0.32	0.43	0.44	0.35	0.17	0.23

Source : *Director of Mines, Odisha and Directorate of Geology, Odisha*

Table 69 represents the district-wise exploration of major minerals in Odisha during 2015-16. It may be observed that about 58.24 percent of coal has been extracted in Angul district and the rest from Jharsuguda, Sundargarh and Sambalpur districts. Iron ore extraction is mostly confined to Keonjhar district which accounts for 67.44 percent of total extraction, followed by Sundargarh (28 percent). Most of the bauxite mining takes place in Koraput district, followed by Rayagada.

Table - 69

Districtwise Break-up Exploration and Value of Major Minerals in Odisha during 2015-16

(Quantity in lakh MT, Value in crores of rupees)

District	Chromite		Coal		Iron-Ore		Manganese-Ore		Bauxite	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Angul			806.96	11652.48						
Dhenkanal	–	–	–	–	–	–	–	–	–	
Jajpur	31.03	3212.16	–	–	29.996	614.03	–	–	–	
Jharsuguda	–	–	455.49	6577.25	–	–	–	–	–	
Keonjhar	–	–	–	–	545.44	11165.16	3.33	41.71	–	
Koraput									63.40	424.74
Mayurbhanj				–	7.459	152.68	–	–	–	
Sundargarh	–	–	117.50	96.67	225.77	4621.46	0.92	122.03	–	
Sambalpur	–	–	5.60	80.91	–	–	–	–	–	
Bolangir			–	–	–	–	–	–	–	
Rayagada								–	44.99	301.42
Total	**31.03**	**3212.16**	**1385.55**	**20007.31**	**808.66**	**16553.33**	**4.25**	**63.74**	**108.40**	**726.16**

***Source** : Director of Mines, Odisha*

Among the districts, almost one-third of the minerals are confined to Angul district alone whereas this district together with Keonjhar constitutes around 60 percent of the state's mineral resources.

Mineral Production in Odisha and other major states of India

The state has shown a consistent growth in the production of Bauxite, Coal and Iron Ore over the last three years. The production of iron ore has increased substantially from 77.84 lakh MT in 2013-14 to 808.66 lakh MT in 2015-16. Similarly the production of Bauxite has increased from 76.35 lakh MT in 2013-14 to 108.40 lakh MT in 2015-16 while the production of coal has increased from 1081.75 lakh MT in 2013-14 to 1385.55 lakh MT in 2015-16. Table 70 shows the production and value of various minerals in Odisha from 2013-14 to 2015-16 and Table 71 shows production of major minerals recorded in major states.

Table - 71

Major Mineral Production Recorded in Major States by the end of 2015-16 (till February - 2016)

(in lakh tone

State	Bauxite	Coal	Chromite	Lime stone	Manganese ore	Fireclay	Iron ore
Andhra Pradesh	–	–	–	297.62	1.73		4.79
Assam	–	3.34	–	6.25	–		0
Bihar	–	–	–	4.33	–		0
Chhattisgarh	19.15	1164.96	–	247.85	–		218.73
Goa	2.91	–	–	–	–		7.81
Gujarat	100.85	–	–	229.2	0.32		–
Himachal Pradesh	–	–	–	112.09	–		–
Jammu & Kashmir	–	0.11	–	1.11	–		–
Jharkhand	19.2	1062.17	–	9.67	0.004		174.25
Karnataka	0.12	–	0.01	244.22	1.29		225.12
Kerala	–	–	–	4.46			–
Madhya Pradesh	5.06	964.36	–	345.76	6.38		22.91
Maharashtra	16.99	337.35	0.0002	119.12	5.53		13.1
Meghalaya	–	35.38	–	35.04	–		–
Odisha	**97.21**	**1243.03**	**24.53**	**40.12**	**3.48**		**706.2**
Rajasthan	–	–	–	602.66	0.03		10.49
Tamil Nadu	0.25	–	–	203.99	–		–
Telangana	–	543.39	–	214.35	0.05		–
Uttar Pradesh	–	112.72	–	24.13	–		–
West Bengal	–	230.5	–	–	–		–
India	**261.74**	**5697.31**	**24.54**	**2741.97**	**18.81**		**1383.2**

***Sources** : Annual Report of IBM 2015-16, Govt. of India*

Value of Output

Table 72 depicts the value of mineral production of major states (including offshore) and India from 2011-12 to 2015-16 (upto February 2016).

Table - 72

Value of Mineral Production of Major States during 2015-16 and its percentage at all India level

(Rupees in crores)

State	2011-12	2012-13	2013-14	2014-15	2015-16
Chhattisgarh				17569.71	13265.03
%				(8.29)	(6.36)
Assam	11439.28	10999.93	11153.47	9814.57	9260.66
%	(8.33)	(7.59)	(4.94)	(4.63)	(4.44)
Meghalaya				3550.43	2580.19
%				(1.67)	(1.23)
Gujarat	13904.76	13046.24	12389.43	10554.04	10258.43
%	(10.12)	(9.00)	(5.49)	(4.98)	(4.92)
Karnataka	4083.18	4409.11	5741.68	5782.47	4121.95
%	(2.97)	(3.04)	(2.54)	(2.73)	(1.98)
Maharashtra	6126.41	6151.88	6898.96	6316.65	5925.81
%	(4.46)	(4.24)	(3.06)	(2.98)	(2.84)
Madhya Pradesh	9659.85	10502.08	11077.07	12568.14	15624.52
%	(7.03)	(7.25)	(4.91)	(5.93)	(7.49)
Odisha*	28597.81	29450.41	54281.60	26470.10	29528.57
%	(20.52)	(20.32)	(24.05)	(12.50)	(14.16)
Telangana				7080.07	8344.43
%				(3.34)	(4.00)
Jharkhand	16308.35	16516.01	20645.27	25645.19	24244.46
%	(11.87)	(11.39)	(9.15)	(12.11)	(11.63)
Rajasthan	17982.98	23502.70	24714.06	22361.36	22689.53
%	(13.09)	(16.21)	(10.95)	(10.56)	(10.88)
Tamil Nadu	5515.44	5744.29	6075.44	5599.24	5321.99
%	(4.02)	(3.96)	(2.69)	(2.64)	(2.55)
West Bengal	8127.39	8882.36	11750.94	4044.37	3528.52
%	(5.92)	(6.13)	(5.2)	(1.91)	(1.69)
Offshore				49792.63	49186.84
%				(23.51)	(23.59)
All India	**137346.78**	**144945.17**	**225659.68**	**211712.22**	**208488.13**
%	**(100.00)**	**(100.00)**	**(100.00)**	**(100.00)**	**(100.00)**

Source : *Annual Report of IBM 2015-16, Govt. of India*

During 2015-16, 13 states (including offshore areas) accounted for about 97.74 percent of total estimated value of mineral production in India. Offshore areas are in leading position with 23.59 percent share in the national output. Odisha lead the major states with a share of 14.16 percent followed by Jharkhand (11.62 percent), Rajasthan (10.88 percent), Madhya Pradesh (7.49 percent), Chhattisgarh (6.36 percent), Gujarat (4.92 percent), Assam (4.44 percent), Telangana (4.00 percent), Maharashtra (2.84 percent), Tamil Nadu (2.55 percent), Karnataka (1.97 percent), West Bengal (1.69 percent) etc. in the total value of mineral production. Remaining states and union territories having individual share of less than 1.23 percent all together accoutned for remaining 2.25 percent of total value during the year under review. Statewise analysis revealed that during 2015-16, the value of mineral production have shown a mixed trend as compared to that in the previous year. The principal mineral production have increased in the states of Odisha, Rajasthan, Madhya Pradesh and Telangana and decreased in the states of Jharkhand, Chhattisgarh, Gujarat, Assam, Maharashtra, Tamil Nadu, Karnataka, West Bengal and Meghalaya.

Minerals Exports

The exports of minerals and ores from the state show a declining trend from 2011-12 to 2014-15. However the export has increased to a great extent during 2015-16 so far the quantity is concerned. (Table 73). Iron ore is the most important mineral in the export basket of all the minerals. Its share in total exports of minerals stood at 96 percent in 2015-16.

Table - 73

Exports of Minerals/Ores from Odisha

(Quantity in lakh MT, Value in crores of rupees)

Items	2011-12		2012-13		2013-14		2014-15		2015-16	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Chromite	3.50	430.69	N.A	N.A	2.01	20.28	0.17	24.26	31.03	32.12
Iron Ore	129.67	3748.68	N.A	N.A	88.15	2933.14	59.77	3092.60	808.66	165.53
Mineral sand	1.56	52.42	N.A	N.A	1.35	432.03	3.65	401.90	0.23	0.00
Manganese	0	0	N.A	N.A	–	–	–	–	4.25	5.64
Others(thermal (coal, hardcoal & ferrochrome)	–	–	–	–	–	–	–	–	0	0
Total	**134.73**	**4231.79**	**N.A**	**N.A**	**91.51**	**3386.05**	**63.59**	**3518.66**	**844.17**	**203.29**

***Source** : Director of Mines, Odisha*

Mineral Revenue

A sum of Rs. 5797.79 crores has been collected during 2015-16 towards mineral revenue out of production, dispatch in the state. The collection of mineral revenue from 2011-12 to 2015-16 is given in Table 74.

Table - 74

Production, Dispatch and Collection of Mineral Revenue 2011-12 to 2015-16

(Production and dispatched in MT and Revenue collection ₹ in crore)

Year	Production	Dispatched	Revenue Collection
2011-12	185.22	171.95	4586.64
2012-13	186.68	173.55	5679.35
2013-14	201.81	226.35	5519.58
2014-15	190.35	193.19	5310.09
2015-16	239.64	241.60	5797.79

***Source** : Directorate of Mines, Govt. of Odisha*

Employment in Mining Sector

Mining and quarrying provides employment to different sections including tribal groups. Table 74 reports the number of workers directly engaged in various mining activities in different years. By end of 2015-16, 49086 numbers of workers are employed directly in major mineral activities. Coal mining employs maximum 19800 direct workers followed by iron ore 18100 workers, chromite 5974 workers, manganese 2415 workers etc. The sector has been increasingly employing labour-savirag and capital-intensive production techniques and technology over the years. It may further be noted that 77 percent of the employed work force get engaged in the iron ore and coal sub-sectors.

Table - 75

Number of workers directly employed in Major Mineral Activities

Mineral Ores/District	2011-12	2012-13	2013-14	2014-15	2015-16
Bauxite (Koraput, Sundargarh)	932	895	674	674	896
Chromite (Dhenkanal, Jajpur, Keonjhar)	7053	6030	5328	5328	5974
Coal (Angul, Jharsuguda, Sundargarh, Sambalpur)	16330	14320	19700	19700	19800
Dolomite and lime stone (Bargarh, Bolangir, Koraput Sundargarh)	496	1760	367	367	450
Iron ore (Jajpur, Keonjhar, Mayurbhanj, Sundargarh)	17257	32901	17611	17611	18100

Mineral Ores/District	2011-12	2012-13	2013-14	2014-15	2015-16
Manganese ore (Keonjhar, Sundargarh Rayagada, Bolangir)	2641	2186	2359	2359	2415
Others (China clay, quartz & quantity, graphite, mineral sand, gem stone, pyrophilite etc.)	3530	1325	1331	1331	1451
Total	**48239**	**59417**	**47370**	**47370**	**49086**

***Source** : Director of Mines, Odisha*

Mining Leases and Auction of Mineral Blocks

There were 377 mining leases in 2015-16, covering an area of 82157.32 ha. Out of these, 101 leases over an area of 45297.68 ha were in operation. Mineral-wise leases, both working and non-working, in Odisha during 2015-16 are listed in Table 76.

The State Govt. has decided to grant mining leases through auction in pursuance of provision of MMDR (Amendment) Act 2015. However, in pursuance of decision of Central Government, the mineral bearing blocks which have been explored up to G2 level are now being processed for auction. The Directorate of Geology and the Geological Survey of India have been advised to do the needful for early completion of exploration in the areas.

Table - 76

Mineral-Wise Leases, 2015-16

Minerals/Ores	Total Leases		Working Leases	
	Nos.	Area in Hectares	Nos.	Area in Hectares
Asbestos	1	117.35	0	0
Asbestos & Pyroxenite	1	49.22	0	0
Bauxite	7	6630.404	3	5060.131
China clay	16	1557.352	2	117.044
China clay & F.clay	2	93.161	0	0
Chromite	25	6998.608	11	1585.759
Chromite & Pyroxenite	1	406.000	1	406.000
Serpentinite, Manganese and Chromite	1	187.03	0	0
Coal	30	20541.941	28	17495.740
Dolomite	5	521.649	3	408.404
Fireclay	24	2675.984	0	0
Fireclay & Sandstone	1	192.175	0	0

Minerals/Ores	Total Leases		Working Leases	
	Nos.	Area in Hectares	Nos.	Area in Hectares
Fireclay & Silica sand	1	255.160	0	0
Galena	1	5.261	0	0
Gemstone	13	150.326	3	5.918
Graphite	104	2834.076	6	182.265
Iron ore & Manganese	65	15088.121	15	4770.356
Iron ore	76	23238.602	27	14785.898
Iron ore & Bauxite	2	480.163	2	480.163
Iron, Dolomite & Limestone	1	134.733	0	0
Total	**377**	**82157.316**	**101**	**45297.678**

Source : Director of Mines, Odisha

District Mineral Fund

Odisha District Mineral Foundations Rules, 2015 have been framed and notified by the State Govt. and subsequently amended on 15.01.2016 to include District Mineral Foundations coming into existence w.e.f. the 12th day of January, 2015, to incorporate the Pradhan Mantri Khanij Kshetre Kalyan Yojana' (PMKKKY) into the DMF Rules. The objective of District Mineral Foundation is to work for the interest and benefit of persons and areas affected by mining related operations. Accordingly, District Mineral Foundation Trust have been constituted in all 30 (thrity) districts with Collector as Chairperson and other designated members as per DMF Rules. The funds of the trust will be utilized for implementing the PMKKKY under Drinking Water Supply, Environmental preservation and pollution control measures, health care, education, welfare of women and children, welfare of aged and disabled people, skilled development, sanitation, housing etc.

Odisha Mining Corporation (OMC)

The Odisha Mining Corporation Limited (OMC), established in 1956, is the largest State Public Sector unit in the country's mining sector. In 2015-16,31 leases covering an area of 17,777.94 ha. have been held by OMC. The details of leases held are shown in Table 77.

Table - 77

Leases Held by OMC at the end of 2015-16

Minerals/Ores	Leased held	
	Nos.	Area in Hectares
Chromite	11	5829.304
Iron	11	5786.9142
Iron & Manganese	5	4175.689
Manganese	3	685.241
Lime stone	1	1300.79
Gemstone	–	–
Total	**31**	**17777.9382**

Source : *Odisha Mining Corporation, Bhubaneswar*

Production of Minerals by OMC

The production of minerals by OMC from 2011-12 to 2015-16 is reflected in Table 78. Irone ore is produced from 6 mines of OMC i.e. Daitari, Gandhamardhan, Kurmitar, Barpada Kasia, Tiring Pahar and Mahaparbat mines, while chrome ore is produced in 3 mines of OMC i.e., South Kaliapani, Bangur and Sukurangi mines. 54 percent of total iron ore are produced in Daitari and Kurmitar mines alone while 87 percent chrome ore is produced in South Kaliapani mines of OMC. Impassively, the iron ore production of 60.19 lakh MT by OMC surpassed its annual revised budgeted target of 57.55 lakh MT made for 2015-16. The production of minerals (iron ore, chrome ore, chrome concentrates and manganese ore) by OMC increased to 70.10 MT during 2015-16 from 39.44 MT during 2014-15. Iron ore shares 86 percent of the total mineral production leaving 14 percent to chrome ore and concentrates by OMC. (Table 78)

Table - 78

Production of Minerals by OMC from 2011-12 to 2015-16

(in lakh MT)

Minerals/Ores	2011-12	2012-13	2013-14	2014-15	2015-16
Iron Ore	42.73	24.55	18.72	32.06	60.20
Chrome Ore	4.34	5.97	5.81	7.01	9.60
Manganese Ore	Nil	Nil	Nil	Nil	Nil
Chrome concentrate	1.07	0.84	0.76	0.37	0.30
Total	**48.14**	**31.36**	**25.29**	**39.44**	**70.10**

***Source** : Odisha Mining Corporation, Bhubaneswar*

Sales of Minerals by OMC

Table 79 gives a detail picture on domestic sales of minerals made by OMC. During 2015-16 OMC made domestic sales of 43.38 lakh MT, 6.14 lakh MT and 0.14 lakh MT of iron ore, chrome ore and chrome concentrates respectively.

Table - 79

Minerals/Ores Sold by OMC

(Quantity in lakh MT Value in Rupees in crore)

Sl. NO	Minerals /Ore	2012-13		2013-14		2014-15		2015-16	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	**Iron Ore**								
	Domestic	27.10	1112.10	31.91	1007.43	34.97	1,083.92	43.38	83804.11
	Export	–	–	–	–	–	–	–	–
	Total	**27.10**	**1112.10**	**31.91**	**1007.43**	**34.97**	**1,083.92**	**43.38**	**83804.11**

Sl. No.	Minerals /Ore	2012-13		2013-14		2014-15		2015-16	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
2	**Chrome Ore**								
	Domestic	3.99	481.67	5.85	736.82	566384.390	747.46	6.14	69512.00
	Export	–	–	–	–	–	–	–	–
	Total	**3.99**	**481.67**	**5.85**	**736.82**	**566384.390**	**747.46**	**6.14**	**69512.00**
3	**Chrome Concentrate**								
	Domestic	–	–	1.24	109.63	48269.750	49.09	0.14	1326.15
	Export	–	–	–	–	–	–	–	–
	Total	**–**	**–**	**1.24**	**109.63**	**48269.750**	**49.09**	**0.14**	**1326.15**
4	**Gemstone**								
	Domestic	–	–	–	–	–	–	–	–
	Export	–	–	–	–	–	–	–	–
	Total	**0.21**							
5	**Aggregate**								
	Domestic	31.86	1658.15	39.00	1853.88	–	–	49.66	154642.26
	Export	–	–	–	–	–	–	–	–
	Total	**31.86**	**1658.15**	**39.00**	**1853.88**	**–**	**–**	**49.66**	**154642.26**

Source *: Odisha Mining Corporation, Bhubaneswar*

Table 80 reflects the annual turnover profit and dividend paid to the State Government from 2011-12 to 2015-16. With a total turnover of ₹ 1546.42 crore and earned a profit before tax provisionally of ₹ 1017.42 crore.

Table - 80

Turnover, Profits and Dividends Paid by OMC

(In crores of rupees)

Year	Turn over	Profit before tax	Dividend paid to Government
2011-12	2141.81	1880.59	500
2012-13	1658.15	1383.46	NA
2013-14	1853.88	1449.95	NA
2014-15	1881.26	1456.25	500.00 (Dividend)
2015-16	1546.42	1017.42	500.00 (Dividend)

Source *: Odisha Mining Corporation, Bhubaneswar*

In order to meet the demand of local market, OMC has decided to go for a 2.5 MTPA iron ore project at its Daitari Mines in Keonjhar district with a project cost of ₹ 600 crore for installation of crushing and screening plant alongwith distance conveyers and rai mode of dispatch of the product. The project has been approved by Govt. of Odisha expected to be completed by 2017.

Geological Surveys and Explorations

Directorate of Geology, Odisha with an objective to fulfil the need of mineral based industries and to augment the mineral resources of the state executes various mineral exploration programme from its headquarters at Bhubaneswar and six zonal offices at Bolangir Berhampur, Dhenkanal, Keonjhar, Koraput and Sambalpur. The exploration programmes are approved in the annual State Geological Programming Board Meeting. In total 11 exploration programmes have been finalized in the 51st SGPB meeting in respect of coal, iron ore manganese, gemstone, graphite, beach sand, heavy minerals and dimension stone including one geophysical survey in the districts of Jharsuguda, Angul, Sundargarh, Keonjhar, Mayurbhanj, Dhenkanal, Kalahandi, Rayagada, Puri and Boudh. All these exploration programmes are continuing in the above districts. In addition to field investigations, Petrological laboratory, Diamond laboratory, Ore dressing laboratory and Gem laboratory are also functioning in the Directorate is examining and certifying the gemstones.

Considering the need of minerals in the state, the Directorate of Geology has taken the following exploration programme for the financial year 2016-17.

(i) Exploration for coal in Madhupur Block, IB Valley coalfield, Jharsuguda District.

(ii) Exploration for iron ore north of Netrabandha Pahar in Sundargarh district.

(iii) Exploration for iron ore in Dholtapahar of Sundargarh district.

(iv) Exploration for Manganese in Roida 'D' block in Keonjhar district.

(v) Exploration for assessment of Gemstone resources in Saraskana area of Mayurbhanj district and Jillingdhar area of Kalahandi districts.

(vi) Exploration for graphite in Rayagada District.

(v) Assessment of heavy minerals in Beach Sand along Puri Coast.

(vi) Investigation for assessment of rocks for use a Dimension store in Boudh District.

(vii) Detailed exploration for limestone in parts of Sundargarh district.

(viii) Geophysical survey in parts of Rayagada district.

New Initiatives

(i) The Government has taken proactive measures to attract investments by creating the concept of "Team Odisha" and "Invest Odisha" for industrial facilitation and investment promotion. New Industrial Policy - 2015 and SEZ Policy - 2015 have been implemented by the Govt. with an aim to attract investment and create industry friendly atmosphrere by extending various fiscal and non-fiscal incentives. Further, OIF, Rules 2004 have been amended keeping in mind the new requirements and opportunities.

(ii) State Govt. drives the Make in India programme launched by Govt. of India and implements the Ease of Doing Business (EoDB) in the state. The state has achieved at 7th place in the World Bank ranking of EoDB assesment. Further the Govt. has setup online processing of Combined Application Forms (CAF) for industries under e-Biz platform of Govt. of India.

Beach Sands Project : IDCOL has signed MOU on 07.02.2015 with Indian Earth Limited (IREL) for development of 1257.03 hects. of Beach Sand area through JV Company. It has been decided to form a JV Company with IREL holding 51 percent and IDCOL holding 49 percent and application will be made to Govt. for reservation of Beach Sand area.

Technology Development Centre : Govt. has sanctioned a budgetary support of ₹1 crore to IDCOL for setting up Technology Development Centre for promotion of low purity Ferro Alloys from leon deposit of nickel bearing late rite ores / COB at Sukinda.

IDCO has planned to establish 12 New Industrial estates of Angul, Balasore, Cuttack, Jharsuguda, Sambalpur, Jagatsinghpur, Khordha, Sundargarh, Bhadrak, Dhenkanal, Ganjam and Rayagada for development of MSME and Ancillary Down Stream Industries for which land acquisition is in progress.

1. The following initiatives have been taken by IPICOL

i) Mapping of manufacturing industries in the state for creation of a comprehensive database on manufacturing industries on a GIS platform.

ii) Creation of a long term roadmap for industrial development of the state.

iii) Developing a mobile application to promote and facilitate investment in Odisha for the targeted users.

iv) Promoting Odisha a preferred destination through a branding partner.

2. OSIC has taken steps for export marketing of MSME products and for this purpose export divisions has been opened on dt.20.1.2016. OSIC has also planned to supply al to MSMEs to be used as raw material. Accordingly, the Corporation has projected to achieve a turnover of ₹ 800.00 crore in the FY 2016-17 with net profit of ₹ 12.00 Cr. The turn over include ₹ 500.00 crore, ₹ 250.00 crore and ₹ 50.00 crore for commercial, marketing and construction works respectively.

3. Besides, the above, the corporation will implement various govt. schemes such as Odisha Youth Innovation Fund, Cluster Development Programme, Venture Capital Fund etc. for the benefit and development of MSME of the state in FY 2016-17.

Conclusion

The industry-led economy of Odisha is quite visible. Manufacturing and mining sectors emerged to contribute sizeable 18.27 percent and 7.36 percent share to Gross State Domestic Product (GSDP) of Odisha respectively in 2016-17 from a meagre 1 percent share each in 1949-50. The shift was required for effective mobilization of natural and human resources, larger employment generation, augmentation of domestic supply and sustainable export promotion for Odisha.

◆

14

TRENDS OF POPULATION GROWTH

- **1991 to 2001 census**
- **2001 to 2011 census (p)**
- **Area, density, decadal growth rate**
- **Sex ratio in 30 districts of Odisha**

To study the population growth if 1901 is taken as the base year, the population of Odisha grew about 113 folds during the first 70 years of the 20th century, whereas in the next 30 years it swelled about 153 % of the base population. Thus speaking precisely, the 10 million people of Odisha in 1901 increased to nearly 36 million at the time of 2001 census.

In 1991-2001 the decadal growth rate was 16.21% but decadal growth rate has decreased to 13.97% in 2001-2011 census. The sex ratio means number of females per 1000 males in 2001 census was 972 but there is marginal increase of 978 in 2011 census (P). The population density per square kilometer in 2001 census was 236 but increased to 269 in 2011 census (P).

The total population 2001 census of Odisha was 3,67,06,920 but it increased to 41,947,358 with decadal growth rate of 13.97% in 2001 Census. In 1991 census the total population of Odisha was 31659736 but it became 36706920 in 2001 census with decadal growth rate of 15.94%. The decadal growth rate is decreasing as per 2011 census.

Table - 85

AREA AND POPULATION

Area, density and decadal growth rate of population in different districts of Odisha

Sl. No.	Name of the District/State	Geographical area in sq. kms	1991 census	Total Population 2001 census (P)	Decadal growth rate 2001 (P) over 1991	Density growth rate per sq. km. 2001 (P) census
1	2	3	4	5	6	7
1.	Angul	6375	961037	1139341	18.55	179
2.	Balasore	3806	1696583	2023056	19.24	532
3.	Baragarh	5837	1207172	1345601	11.47	231
4.	Bhadrak	2505	1105834	1332249	20.47	532

Sl. No.	Name of the District/State	Geographical area in sq. kms	1991 census	Total Population 2001 census (P)	Decadal growth rate 2001 (P) over 1991	Density growth rate per sq. km. 2001 (P) census
5.	Bolangir	6575	1230938	1335760	8.52	203
6.	Boudh	3098	317622	373038	17.45	120
7.	Cuttack	3932	2053192	2340686	14.00	595
8.	Deogarh	2940	234238	274095	17.02	93
9.	Dhenkanal	4452	947870	1065983	12.46	239
10.	Gajapati	4325	454708	518448	14.02	120
11.	Ganjam	8206	2704056	3136837	16.01	382
12.	Jagatsinghpur	1668	933789	1056556	13.15	633
13.	Jajpur	2899	1386177	1622868	17.08	560
14.	Jharsuguda	2081	442154	509056	15.13	245
15.	Kalahandi	7920	1130903	1334372	17.99	168
16.	Kandhamal	8021	546281	647912	18.06	81
17.	Kendrapara	2644	1149501	1301856	13.25	492
18.	Keonjhar	8303	1337026	1561521	16.79	188
19.	Khurda	2813	1502014	1874405	24.79	666
20.	Koraput	8807	1029577	1177954	14.41	134
21.	Malkangiri	5791	422326	480232	13.71	83
22.	Mayurbhanj	10418	1884580	2221782	17.89	213
23.	Nawarangpur	5291	846659	1018171	20.26	192
24.	Nayagarh	3890	782647	863934	10.39	222
25.	Nuapada	3852	469482	530524	13.00	138
26.	Puri	3479	1305365	1498604	14.80	431
27.	Rayagada	7073	713984	823019	15.27	116
28.	Sambalpur	6657	813589	928889	14.17	140
29.	Sonepur	2337	476815	540659	13.39	231
30.	Sundargarh	9712	1573617	1829412	16.26	188
	ODISHA	**155707**	**31659736**	**36706920**	**15.94**	**236**

P : Provisional

Source : Census of India

Provisional Population Tables

Table - 86

Distribution of Population, Decadal Growth Rate, Sex-Ratio and Population Density 2011 Census (p)

District Code	State/Districts	Population 2011			Percentage decadal growth rate of population		Sex-Ratio (Number of Females per 1000 Males)		Population density per sq. km.	
		Persons	Males	Females	1991-01	2001-11	2001	2011	2001	2011
1	2	3	4	5	6	7	8	9	10	11
	Odisha	**41,947,358**	**21,201,678**	**20,745,680**	**16.25**	**13.97**	**972**	**978**	**236**	**269**
1	Bargarh	1,478,833	748,332	730,501	11.53	9.84	976	976	231	253
2	Jharsuguda	579,499	297,014	282,485	15.25	12.56	946	951	244	274
3	Sambalpur	1,044,410	529,424	514,986	15.01	12.24	969	973	140	158
4	Debagarh	312,164	158,017	154,147	17.02	13.88	980	976	93	106
5	Sundargarh	2,080,664	1,055,723	1,024,941	16.34	13.66	957	971	188	214
6	Kendujhar	1,802,777	907,135	895,642	16.83	15.42	977	987	188	217
7	Mayurbhanj	2,513,895	1,253,633	1,260,262	17.98	13.06	980	1005	213	241
8	Baleshwar	2,317,419	1,184,371	1,133,048	19.33	14.47	953	957	532	609
9	Bhadrak	1,506,522	760,591	745,931	20.61	12.95	974	981	532	601
10	Kendrapara	1,439,891	717,695	722,196	13.27	10.59	1014	1006	492	545
11	Jagatsinghpur	1,136,604	577,699	558,905	13.26	7.44	963	967	634	681
12	Cuttack	2,618,708	1,339,153	1,279,555	14.02	11.87	938	955	595	666
13	Jajapur	1,826,275	926,058	900,217	17.18	12.43	972	972	560	630
14	Dhenkanal	1,192,948	612,597	580,351	12.56	11.82	961	947	240	268
15	Anugul	1,271,703	654,898	616,805	18.62	11.55	941	942	179	199
16	Nayagarh	962,215	502,194	460,021	10.46	11.30	938	916	222	247
17	Khordha	2,246,341	1,166,949	1,079,392	24.99	19.65	902	925	667	799
18	Puri	1,697,983	865,209	832,774	15.12	13.00	968	963	432	488
19	Ganjam	3,520,151	1,777,324	1,742,824	16.88	11.37	998	981	385	429
20	Gajapati	575,880	282,041	293,839	14.10	10.99	1031	1042	120	133
21	Kandhamal	731,952	359,401	372,551	18.66	12.92	1008	1037	81	91
22	Baudh	439,917	220,993	218,924	17.55	17.82	984	991	121	142
23	Subarnapur	652,107	332,897	319,210	13.64	20.35	966	959	232	279
24	Balangir	1,648,574	831,349	817,225	8.63	23.29	984	983	203	251

District Code	State/Districts	Population 2011			Percentage decadal growth rate of population		Sex-Ratio (Number of Females per 1000 Males)		Population density per sq. km.	
		Persons	Males	Females	1991-01	2001-11	2001	2011	2001	2011
1	2	3	4	5	6	7	8	9	10	11
	Odisha	41,947,358	21,201,678	20,745,680	16.25	13.97	972	978	236	269
25	Nuapada	606,490	300,307	306,183	13.04	14.28	1007	1020	138	157
26	Kalahandi	1,573,054	785,179	787,875	18.09	17.79	1001	1003	169	199
27	Rayagada	961,959	469,672	492,287	16.40	15.74	1028	1048	118	136
28	Nawarangpur	1,218,762	604,046	614,716	21.15	18.81	991	1018	194	230
29	Koraput	1,376,934	677,864	699,070	14.67	16.63	999	1031	134	156
30	Malkangiri	612,727	303,913	308,814	19.39	21.53	997	1016	87	106

* For Calculation of sex ratio total of males and others as males used

Table - 87

Percentage Decadal Variation in Population for State and Districts : 1901 - 2011

District Code	State/ Districts	Percentage Decadal Variation										
		1901-11	1911-21	1921-31	1931-41	1941-51	1951-61	1961-71	1971-81	1981-91	1991-01	2001-11
1	2	3	4	5	6	7	8	9	10	11	12	13
	Odisha	10.44	–1.94	11.94	10.22	6.38	19.82	25.05	20.17	20.06	16.25	13.97
1	Bargarh	15.80	4.54	11.75	12.63	8.25	13.25	21.14	22.95	16.93	11.53	9.84
2	Jharsuguda	15.81	4.54	11.75	12.63	8.23	5.05	18.48	25.74	21.31	15.25	12.56
3	Sambalpur	15.79	4.54	11.75	12.63	8.26	25.32	23.20	24.32	18.50	15.01	12.24
4	Dehagarh	15.80	4.54	11.75	12.63	8.25	24.16	33.11	21.09	18.50	17.02	13.88
5	Sundargarh	30.65	4.23	15.74	12.33	12.53	37.38	35.87	29.79	17.62	16.34	13.66
6	Kendudhar	27.63	4.06	21.37	15.02	11.07	26.32	28.55	16.65	19.95	16.83	15.42
7	Mayurbhanj	19.47	3.44	17.94	10.69	4.48	17.03	19.12	10.30	19.14	17.98	13.06
8	Baleshwar	–1.39	–6.99	1.29	4.68	–0.25	27.38	30.05	24.42	24.96	19.33	14.47
9	Bhadrak	–1.39	–6.99	1.29	4.68	–0.25	28.97	28.16	21.08	23.55	20.61	12.95
10	Kendrapara	2.42	–2.81	6.45	4.71	3.32	23.36	26.79	19.16	17.15	13.27	10.59
11	Jagatsinghpur	2.42	–2.81	6.45	4.71	3.32	18.27	22.80	23.47	17.98	13.26	7.44
12	Cuttack	2.42	–2.81	6.45	4.71	3.32	20.91	25.03	21.59	19.37	14.02	11.87
13	Jajapur	2.42	–2.81	6.45	4.71	3.32	21.70	24.78	19.77	22.01	17.18	12.43
14	Dhenkanal	3.29	-12.81	23.38	16.72	13.12	22.70	26.37	19.79	18.92	12.56	11.82
15	Anugul	3.29	-12.81	23.38	16.72	13.12	22.54	25.70	25.01	22.31	18.62	11.55

District Code	State/ Districts	Percentage Decadal Variation										
		1901-11	1911-21	1921-31	1931-41	1941-51	1951-61	1961-71	1971-81	1981-91	1991-01	2001-11
16	Nayagarh	1.96	-10.04	10.81	8.07	7.93	19.97	22.86	18.13	14.52	10.46	11.3
17	Khordha	1.96	-10.04	10.81	8.07	7.93	17.99	30.46	31.87	32.67	24.99	19.6
18	Puri	1.96	-10.04	10.81	8.07	7.93	17.75	22.78	22.31	18.08	15.12	13.0
19	Ganjam	11.18	-3.25	13.24	12.19	4.11	16.57	22.51	16.60	19.25	16.88	11.3
20	Gajapati	11.18	-3.25	13.24	12.19	4.11	8.39	22.41	15.28	13.04	14.10	10.9
21	Kandhamal	13.17	-0.45	9.38	9.33	1.52	12.04	21.54	14.00	21.69	18.66	12.9
22	Baudh	13.17	-0.45	9.38	9.33	1.52	13.55	19.67	17.75	18.35	17.55	17.8
23	Subarnapur	39.50	15.50	11.60	8.32	5.28	13.71	17.51	23.19	19.99	13.64	20.3
24	Balangir	39.50	15.50	11.60	8.32	5.28	17.40	18.50	12.82	15.94	8.63	23.2
25	Nuapada	20.34	1.82	19.05	13.75	8.10	21.57	26.80	15.87	19.56	13.04	14.2
26	Kalahandi	20.34	1.82	19.05	13.75	8.10	16.01	21.39	14.73	19.48	18.09	17.7
27	Rayagada	20.22	-3.12	17.93	18.55	12.37	18.24	26.73	19.05	17.29	16.40	15.7
28	Nawarangpur	20.22	-3.12	17.93	18.55	12.37	27.79	29.74	24.39	24.22	21.15	18.8
29	Koraput	20.22	-3.12	17.93	18.55	12.37	9.01	20.54	20.05	19.93	14.67	16.6
30	Malkangiri	20.22	-3.12	17.93	18.55	12.37	33.12	89.40	24.66	26.00	19.39	21.5

Table - 88

Sex-ratio for State and Districts : 1901-2011

District Code	State/ Districts	Sex-ratio (Number of females per 1000 males) since											
		1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	2011
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Odisha	**1037**	**1056**	**1086**	**1067**	**1053**	**1022**	**1001**	**988**	**981**	**971**	**972**	**978**
1	Bargarh	1018	1029	1033	1044	1035	1022	1013	995	989	979	976	976
2	Jharsuguda	1019	1029	1034	1044	1036	1017	978	960	954	938	946	951
3	Sambalpur	1018	1028	1033	1043	1034	982	977	959	958	956	969	973
4	Debagarh	1018	1029	1033	1044	1035	1019	1001	977	969	982	980	976
5	Sundargarh	959	988	1004	1013	1017	1012	915	942	931	936	957	971
6	Kendujhar	963	1004	1032	1028	1011	995	982	977	983	974	977	987
7	Mayurbhanj	1013	1011	1015	1011	1005	1001	991	987	989	979	980	1005
8	Baleshwar	1065	1087	1098	1058	1024	952	956	965	965	955	953	957
9	Bhadrak	1065	1087	1098	1058	1024	1046	1000	983	996	985	974	981
10	Kendrapara	1068	1101	1159	1112	1084	1038	1020	1011	1000	1007	1014	1006
11	Jagatsinghpur	1068	1101	1160	1112	1084	1052	1049	1017	985	977	963	967
12	Cuttack	1068	1101	1159	1112	1083	986	946	947	937	922	938	955
13	Jajapur	1068	1101	1159	1112	1084	1056	1027	1006	995	977	972	972

State/ Districts	Sex-ratio (Number of females per 1000 males) since										
	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	2011
Dhenkanal	1020	1035	1074	1053	1030	1029	1001	980	967	954	961	947
Angul	1020	1035	1074	1053	1030	1005	980	975	949	942	941	942
Nayagarh	1009	1023	1097	1078	1082	1048	1021	994	972	958	938	916
Khordha	1009	1023	1097	1078	1082	1046	1015	964	942	903	902	925
Puri	1009	1023	1097	1078	1082	1001	984	979	972	970	968	963
Ganjam	1119	1159	1223	1191	1169	1127	1092	1045	1033	1006	998	981
Gajapati	1119	1159	1223	1191	1169	1041	1027	1026	1023	1027	1031	1042
Kandhamal	1013	1013	1018	1022	1021	1025	1025	1013	1005	999	1008	1037
Baudh	1013	1013	1018	1022	1021	998	990	989	988	987	984	991
Subarnapur	1042	1030	1028	1025	1020	1012	1006	993	984	979	966	959
Balangir	1042	1030	1028	1025	1020	1010	999	993	995	981	984	983
Nuapada	1004	1024	1031	1035	1035	1011	1019	1011	1013	1002	1007	1020
Kalahandi	1004	1024	1031	1035	1035	1023	1020	1010	1009	999	1001	1003
Rayagada	966	999	1000	1004	996	1008	1010	1004	1020	1012	1028	1048
Nawarangpur	966	998	1000	1004	996	984	982	983	991	989	991	1018
Koraput	966	999	1000	1004	996	981	981	978	988	991	999	1031
Malkangiri	966	998	1000	1004	996	1015	998	936	962	985	997	1016

* For calculation of sex ratio, others have been considered as males

Table - 89

Literacy Rates by Sex for State and District : 2001 and 2011

strict Code	State/ Districts	Literacy Rate					
		Persons		Males		Females	
		2001	2011	2001	2011	2001	2011
1	2	3	4	5	6	7	8
	Odisha	**63.08**	**73.45**	**75.35**	**82.40**	**50.51**	**64.36**
1	Bargarh	63.99	75.16	77.41	84.28	50.26	65.84
2	Jharsuguda	70.55	78.36	81.23	86.27	57.80	70.05
3	Sambalpur	67.29	76.91	79.49	85.17	55.52	68.47
4	Debagarh	60.36	73.07	73.33	82.62	47.18	63.36
5	Sundargarh	64.86	74.13	75.34	82.13	53.88	65.93
6	Kendujhar	59.24	69.00	71.99	79.22	46.22	58.70
7	Mayurbhanj	51.91	63.98	65.76	74.92	37.84	53.18
8	Baleshwar	70.56	80.66	81.69	88.06	58.90	72.95
9	Bhadrak	73.86	83.25	84.65	89.92	62.85	76.49

District Code	State/ Districts	Literacy Rate					
		Persons		Males		Females	
		2001	2011	2001	2011	2001	2011
1	2	3	4	5	6	7	8
10	Kendrapara	76.81	85.93	87.11	92.45	66.76	79.51
11	Jagatsinghpur	79.08	87.13	88.53	93.20	69.26	80.88
12	Cuttack	76.66	84.20	85.83	90.51	66.90	77.64
13	Jajapur	71.44	80.44	81.89	87.36	60.76	73.37
14	Dhenkanal	69.42	79.41	80.57	87.08	57.89	71.40
15	Anugul	68.79	78.96	81.43	87.06	55.37	70.44
16	Nayagarh	70.52	79.17	82.66	86.63	57.64	71.08
17	Khordha	79.59	87.51	87.90	92.55	70.36	82.06
18	Puri	77.96	85.37	88.08	91.84	67.57	78.67
19	Ganjam	60.77	71.88	75.22	81.85	46.44	61.84
20	Gajapati	41.26	54.29	54.71	65.58	28.42	43.59
21	Kandhamal	52.68	65.12	69.79	78.41	35.86	52.46
22	Baudh	57.73	72.51	76.23	84.49	39.02	60.44
23	Subarnapur	62.84	74.42	78.94	84.78	46.17	63.63
24	Balangir	55.70	65.50	71.67	77.08	39.51	53.77
25	Nuapada	42.00	58.20	58.46	71.55	25.79	45.21
26	Kalahandi	45.94	60.22	62.66	73.34	29.28	47.27
27	Rayagada	36.15	50.88	48.18	62.61	24.56	39.87
28	Nawarangpur	33.93	48.20	47.04	59.45	20.67	37.22
29	Koraput	35.72	49.87	47.20	61.29	24.26	38.92
30	Malkangiri	30.53	49.49	40.14	60.29	20.91	38.95

Note : *Literacy Rate is the Percentage of literates to population aged 7 years and above.

If we evaluate among 30 district of Odisha the highest decadal growth rate of 24.79% was seen in 2001 census but it decreased to 19.65% in 2011 census. (Table 87)

The density of population as per 2011 census (P) was 269 but 12 districts of Odisha had more than 269 density and 18 districts had less than 269 density (Table 86).

The highest literacy rate among females in 2011 census (P) was seen in Khorda district with 82.06% and the lowest literacy data of 37.22% was seen at Nawarangpur.

The literacy rate in Odisha was 63.08% in 2001 census but it increased to 73.45% in 2011 census (p). Table (89).

Odisha is the 11th most populous state in India and home of 41.95 million people as per 2011 census (P). Out of this, rural population is 34.95 million and urban population is 70 million. The rural population constitute 83 perent. The agriculture and agro-based cottage industry is the main activity of rural population.

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